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ABSTRACT

This report summarizes the results of research and development concerning disabled individuals in Sweden and their use of transport facilities. The first section, "People with Impaired Mobility and Their Travel Needs," outlines Sweden's transport policy goal to adapt transport to the needs of disabled people, addresses the difficulty in ascertaining which people are disabled in terms of transport, and cites statistics which show that disabled people travel less frequently than others but are traveling more than they did in the past. The second section, on "Means of Transportation Designed for the Disabled," describes municipal Special Transportation Services using taxis or special-purpose vehicles, the national Special Transportation Service, bus service routes especially designed to serve the needs of the elderly and disabled, and subsidies for individual trips by car. Under the heading, "Adapting Public Transport Facilities for the Disabled," the third section discusses many ways of solving the travel problems of the disabled, including adaptation of buses, trains, planes, boats, and taxis, and modification of terminals, stations, and bus stops. "Vehicles for Disabled People," the final section, focuses on the need for taxicabs, small buses, and other special purpose vehicles suitable for transporting the disabled. Includes approximately 60 references. (JLD)

Swedish Transport Research Board

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Mats Börjesson

REPORT
1989:1

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This report is intended to provide an overall picture of, and summarize, the results of research and development projects concerning disabled people and transportation. The report is primarily a summary of the results of projects supported by the Swedish Transport Research Board and its predecessors, but results from a number of other published reports have also been included.

Swedish Transport Research Board

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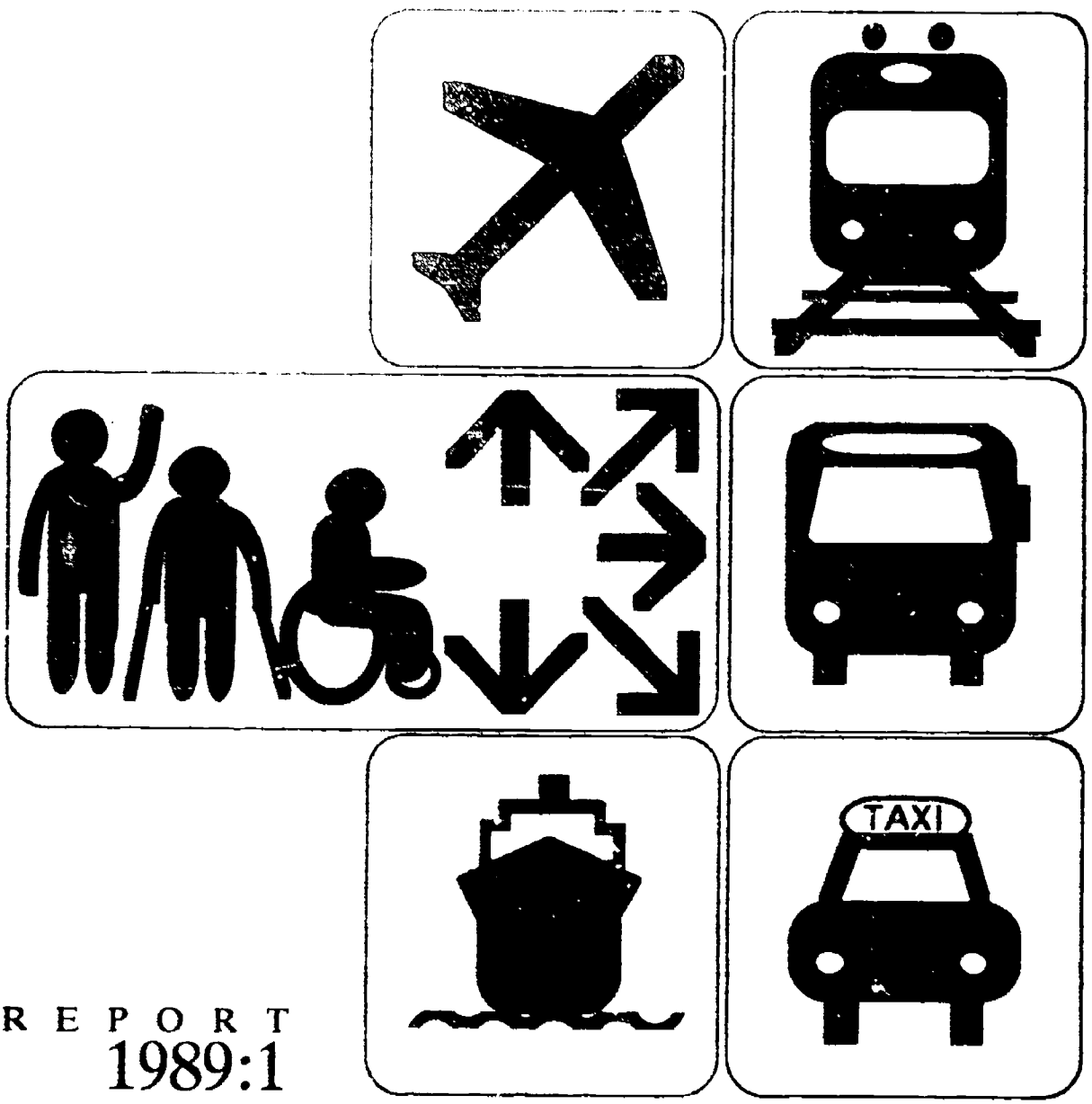

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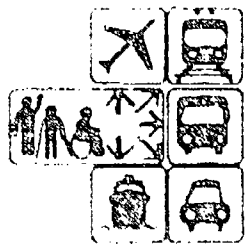

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SUMMARY
One of the most important goals of Swedish transportation policy is that everyone, even the disabled, should be offered equitable and satisfactory transport facilities, and thus have access to employment opportunities and participation in social life.
To achieve that goal, and find practical solutions that can facilitate travel by the disabled, extensive research and development activities have been conducted during the 1970s and '80s. This report is primarily a summary of the results of research and development concerning the disabled and transport facilities, supported by the Swedish Transport Research Board and its predecessors, the Swedish Transport Research Delegation and the Public Transport Board. Other published reports, however, have also been included, in order to provide a more comprehensive overview of the situation.

People with Impaired Mobility and Their Travel Needs

It is not easy to know where to draw the line for being disabled in traffic, and to count the number of people so affected. Several different ways of counting are used.
The number of people in Sweden who feel that they have diminished locomotive faculties is ca 1.1 million. Of these, many have mentioned specific disablements. For example, nearly 600,000 have reported difficulty going up and down stairs.
Another measurement of the number of disabled people in traffic is the number of people with certain illnesses, e.g. allergies, or the number entitled to Special Transportation Service (STS); in 1985, 360,000 people were so entitled. (Not all of these people suffer physical disabilities.)
Since age and traffic handicaps are often associated, the specific problems of the elderly are often studied. Of all people who report impaired mobility, ca 70% are over 65.

People with diminished locomotive faculties travel considerably less than those who are completely mobile. People who have locomotion impairments walk more, and use other means of getting about less, than others. A large part of the travel undertaken by the disabled is in private automobiles. STS is used by only about one-fourth of those entitled to it for their day-to-day travel.

The greatest change in the immediate future will be the increase in the number of older people who have cars. According to

one succinct estimate, automobile travel among the elderly will increase by 30%, while their use of public transport will decrease by 25%. Improved pensions in the future may further enhance this development.

Means of Transportation Designed for the Disabled

The clearly dominant means of transportation for disabled people is taxi service, paid for by local or national Special Transportation Service (STS). Taxis are almost always ordinary passenger cars that are not especially adapted for the disabled. Special-purpose vehicles account for only about 7% of STS trips.

The usual fare for STS passengers is 20% or less of the metered charge. In ca 10% of the municipalities, the charge for STS trips is the same as for using public transport.

Many municipalities have tried to limit the cost increase for STS by various means. No clear-cut effect on costs has been realized by redrawing the districts served, restricting STS to health-care trips, and offering free public transport to people entitled to STS. Increased fares, and mandatory advance reservations and ride-sharing, decrease travelling. Coordination of trips reduces expenses, but it requires personnel and, perhaps, computerization.

National STS has existed since 1980 for ca 5% of those entitled to municipal STS. Since a great many of the trips using national STS are short, and occur within a county, an experiment with county-wide STS was begun in Östergötland in 1987. Evaluation of county-wide STS is currently underway.

Service Routes consist of routes within the public transport sector that are laid out to fulfill the needs of the elderly and disabled. Small vehicles that are easy for disabled people to use drive close to domiciles and important destinations. Hopefully, Service Routes will decrease the demand for STS by taxi; studies indicate that ca 25% of STS passengers can use public transport if the traffic pattern is suitably adjusted.

Adapting Public Transport Facilities for the Disabled

The research carried out has placed great emphasis on technical modifications of vehicles, and has resulted in, among other things, handbooks for the adaptation of buses, trains, boats

and airplanes to the needs of disabled people. Research into the adaptation of taxis is still going on. The Transportation Council's regulations for the adaptation of different vehicles are largely modelled on the results of various research and development projects. Travelling is made easier for people with impaired locomotion, poor eyesight or other disabilities if adaptations are introduced in such areas as information, seating, handles and railings, boarding steps, onloading of wheelchairs, lighting, and so on.

However, it is not only vehicles that need to be adapted. Improvements should be made at ca 800 terminals, stations, airports and harbors, and at 117,000 bus stops. The way to and from public transport, as well as service and assistance in connection with the trip, can make all the difference for certain people as to whether they can travel or not. It has been demonstrated in Gävle that it is possible to substantially improve the possibilities for older people to take the bus by means of pavement surface repairs, driver attitude modification, and service enhancement.

Thus far, however, the gradual incrementation of adaptations of public transport for the disabled has not been fruitful. There is no indication that more disabled and/or elderly people choose buses and trains instead of other modes of travel. This is true despite the fact that a large number of disabled people have the potential to use public transport.

Vehicles for Disabled People

There are no taxis suitable for transporting disabled people. Certain vehicles meet the minimum functional measurements with regard to door width and entry at the front door. The height of the doors is a greater problem. The minimum requirement set for the state inspection of taxis does not conform to the functional measurements. Minibuses used as taxis have an adequate door height, but on the other hand, the entry and the floor are too high.

Special-purpose vehicles are fitted and equipped for passengers confined to their wheelchairs. The necessary changes are primarily a hoist or a ramp for onloading the wheelchair, and facilities for locking it in place once it is aboard. On certain vehicles, the ceiling must also be raised, because it must be at least 145 cm above floor level.

For Service Routes, the simple choice of a minibus with a low boarding step is not sufficient. The vehicle should preferably also not have steps inside, nor side-seating, since they both reduce the possibilities of using the bus by the group of passengers they are trying to serve. The Orion II, which was

tested in Borås, satisfies, in principle, all of the requirements placed on vehicles by passengers using Service Routes.

Safety

The overall picture that results from a number of studies shows that disabled drivers, as a group, do not have a higher accident frequency than others. Many disabled people, however, have skeletal anomalies which imply increased risk of injury. Collision tests with passengers in wheelchairs reveal that adequate protection is not provided if the only safety precautions are a lap belt and locking the chair in place. Better protection is provided by a three-point seat belt attached to the vehicle.

Elderly people, as a group, are often injured in traffic. The underlying cause of the problems they confront in traffic is not functional impairment per se, but rather the fact that today's traffic is so complicated. A study conducted in Malmö shows that nearly 80% of accidents where an older person is struck by a vehicle occur at crossings. These situations are characteristically very complex. In situations where elderly people can make use of previous experience, and where nothing out of the ordinary happens, they are less likely to be involved in accidents.

People with Impaired Mobility and Their Travel Needs.

1. The Goal of Transport Policy is to Adapt Traffic to the Needs of the Disabled People

One of the most important goals of traffic policy in Sweden is good accessibility to transportation for everyone in society. This means that everyone should be offered equitable and satisfactory transport facilities that provide the opportunity to participate in the employment sector and in social life. -- Even disabled people should, as far as possible, be able to count themselves members in the fellowship of their community; they should be given the same living conditions as other people.

At the same time, there is a social goal of making it possible for the elderly and disabled to live in their habitual environment. Disabled people should lead normal lives, and be integrated members of their society. Hence the possibility of moving about is crucial. If they are to participate in various social activities, both communications and the environment must be adapted to the need of the elderly and disabled to get around. We know, however, that disabled people do not have the same opportunities for getting around as other people. Modes of transport, the traffic environment and the general surroundings pose demands that result in restricted travel prospects.

These goals have taken shape during the debate of the 1970s and 80s about the situation of disabled people in society. During the same period, extensive research and development has sought to produce practical solutions for facilitating the travels of disabled people. The present report is primarily an account of the results of research supported by the Swedish Transport Research Board and its predecessors, the Transport Research Delegation and the Public Transport Board. To achieve a more complete picture of the results of research in Sweden, however, reports published under other auspices have also been included.

The approximately 50 reports cited can be grouped into four areas that illustrate the direction taken by research and development activities.

AREA	Number of Reports
People with impaired mobility and their travel needs	10
Special modes of transport for disabled people	11
Adapting public transport for the disabled	18
Vehicles for disabled people	12

In addition, there are some reports (addressed to safety, wheelchairs, and neighborhoods, for example), that do not fit into any of these four groups.

The research has greatly emphasized the technical modification of vehicles. Less often considered are the effects of adaptation for the disabled from the viewpoints of business economics and public finances.

There are about one million people in Sweden who are disabled in terms of being able to get about. About half of them have relatively minor functional impairments. Among these, it is estimated that ca 400,000 people have difficulty walking, ca 300,000 suffer hearing loss, ca 70,000 have poor eyesight, and ca 150,000 are the victims of allergies.

The Swedish society's efforts to facilitate travel by disabled people consist of municipal Special Transportation Service (STS), automobile subsidies, adaptation of public transport, and national STS.

Measures Taken	Cost	Number Targeted (million SEK/year)
Municipal STS (1985)	982	360,000
National STS (1985/86)	47	18,600
Automobile subsidy (1985)	75	10,300
Adaptation of public transport (1985) Prop 1987/88:50	50	1,000,000

The number of disabled people in traffic constitutes ca 12% of the Swedish population. Studies in the rest of Scandinavia and other European countries have produced similar figures. The estimate for Scandinavia is that some 2,500,000 people, or ca 10% of the population, are disadvantaged in traffic. For other European countries the figure is around 10-12% (NÄT 1987, EMCT 1986).

In 1979, the Swedish Parliament decided that public transport would be adapted for the disabled. This legislation was preceded by extensive investigatory activity, an

undertaking which was continued to provide a foundation for regulations and to find suitable measures for realizing the formulations of the law. The content of the regulations resulting from the legislation was largely based on the research conducted during the 1980s.

The Law Governing Adaptation of Public Transport for the Disabled

The legislation prescribes that those who are responsible for public transport, and those who operate it, assure that it is adapted to the requirements of disabled people.

When public transport is planned and carried out, the special needs of the disabled are to be accommodated to the extent possible.

The vehicles used are to be adapted for handicapped passengers to the extent possible.

The adaptation is to be carried out at the rate, and to the extent, deemed reasonable in terms of the objective, and in consideration of the technical and economic resources of the operators of public transport.

The adaptation is to take into account the particular conditions that apply to public transport in densely populated areas. Consideration will also be paid to the safety needs of the passengers.

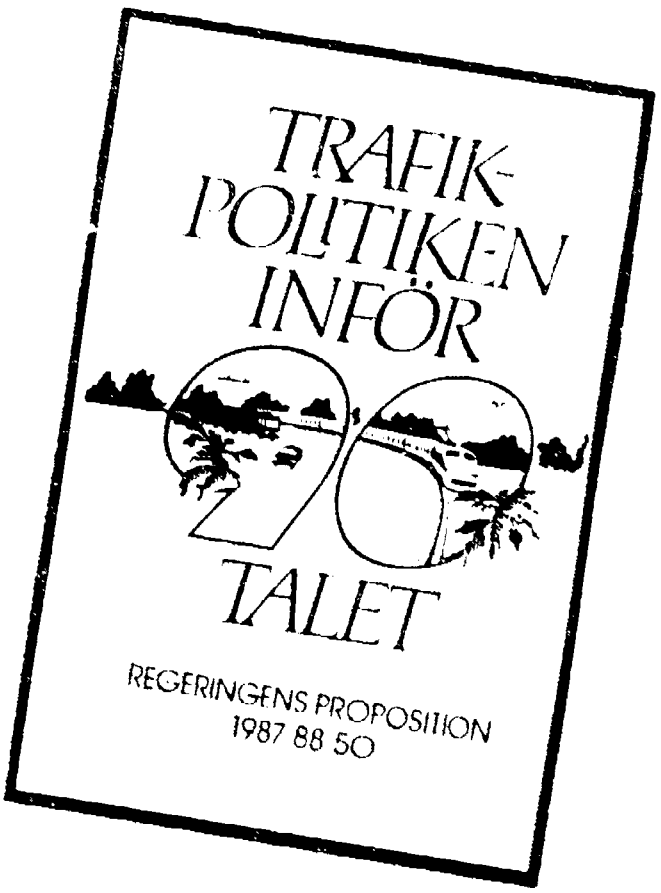
The Board of Transport is to initiate, plan, and monitor the adaptation, and to take appropriate measures to coordinate it.

A time-consuming process, and high expectations

Sweden has thus far been the pioneer in trying to attain transport adapted for the disabled through mandatory legislation. This process is wide-ranging and time-consuming. The demand for a traffic environment adapted to the needs of disabled people was raised as early as the 1960s and the early 1970s. In 1973, the HAKO Commission was appointed, and it reported its findings in 1975. 1979 witnessed the proposition, the Parliament's decision, and the legislation. During the 1980s, starting at the turn of the year 1981/82, regulations for applying the law to the different means of transportation have emerged. However, there is still a long way to go before the modifications fully penetrate the transport system. The main reason for this is the long service life of most means of transport.

Because the adaptation of public transport for disabled people has been legislated, expectations have been high. But the law's formulation, "to the extent possible," is very hard to concretize. In addition, the adaptation measures have had to be paid for by the transportation companies themselves. Until the Parliament's decision concerning traffic policy in the spring of

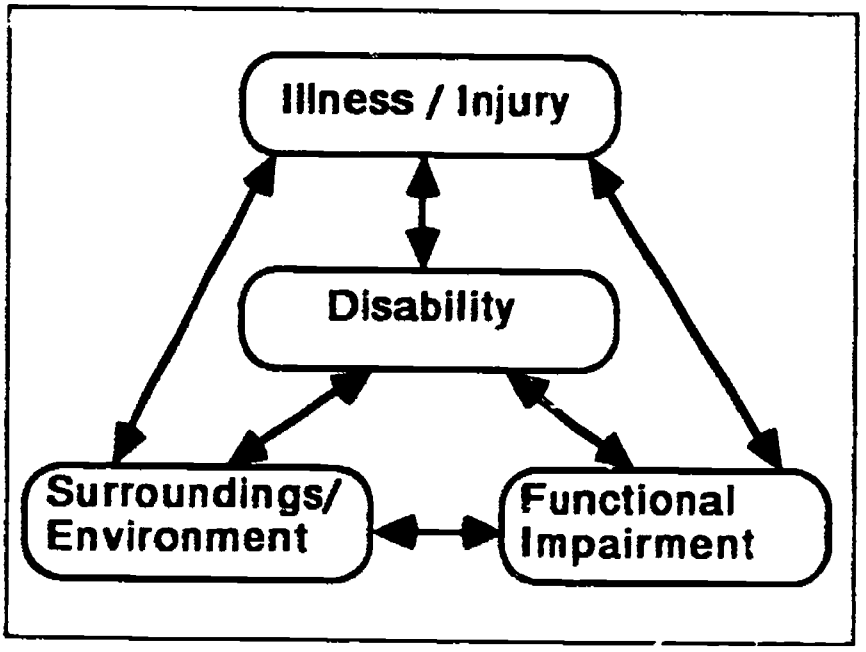
1988, there had been no national monies whatsoever earmarked for achieving the adaptation of public transport. Still another problem is defining the demarcation between special solutions for disabled people and adapting other traffic to the needs of the disabled (CHOROS 1986:9).



Following a decision in the spring of 1988 about new traffic policy for the 1990s, transportation companies can receive grants for implementing adaptations of public transport.

2. The Difficulty of Ascertaining Which People Are Disabled in Traffic.

It is not easy to find out how many people are disabled in traffic or have impaired mobility. For one thing, the definition of being disabled in traffic is not entirely clear; for another, it is hard to calculate the numbers.



"Disability" is a relative concept that can be described in terms of illness and physical injury, functional impairment, surroundings and environment.

"Disability" is a relative concept that is used in many different connections. Sometimes, it is used as a collective description of people with certain physical injuries or diseases, for example, those who have lost their eyesight or have allergies. Disability can also be a collective concept for people with functional impairments of various kinds -- those who cannot walk, or who suffer hearing loss. Classifications of this kind are complicated because a physical injury can lead to functional impairment, but need not always do so.

The whole matter is further complicated because disability depends on surroundings and environment. For example, the severity of the problems caused by physical injuries and functional impairments depends entirely on one's surroundings. A person may be totally disabled in a certain environment, but have no problems in a different one.

A disability can also vary from time to time. It may, for instance, be more troublesome in wintertime, when getting around can generally be difficult.

Four methods for determining which people are disabled in traffic

Since there is no one clear-cut description of who is disabled, neither is it easy to describe who is disabled in traffic. To determine this, several points of departure have been employed in studies and reports.

- **The experience of being disabled**

The experience of impaired mobility is one assessment offered by the disabled themselves. In interviews, these people report difficulties they encounter in getting about. An example of the studies with this classification is the Resvaneundersökningen [Travel Habits Inquiry] of 1978.

- **Entitlement to Special Transportation Services**

According to municipal rules governing STS, entitlement is granted to people who have trouble getting around. It is not the individual who estimates his/her difficulty, but someone else who makes an overall evaluation of the need for STS. An example of the studies with this classification is Färdtjänstens utveckling och framtid [STS's Development and Future]. (TFB Stencil #26)

- **Illness or injury**

A third way to determine who is disabled in traffic is to report the number of people with different injuries or illnesses.

- **The elderly**

"Elderly" generally refers to people who are 65 and older. Because such a large component of those who are disabled in traffic are elderly, many studies are devoted to older people and their travel problems.

These different approaches are also used in combination. For example, there are investigations of older people who can report problems they have encountered. None of the four methods gives a clear-cut picture of which people suffer from impaired mobility, but taken together, they provide good insight into the dimensions of the problem.

• The experience of being disabled

Hence disablement in traffic is a relative concept. It occurs when the demands of the surroundings are too great for the individual's functional ability. From that point of view, one can describe impaired mobility by using the difficulties the individual reports in getting about.

Inquiries into the Swedish population's travel habits have previously been conducted on two occasions, in 1978 and 1984/85. The 1978 study (RVU-78) contained, among other things, information about disablement. From these inquiries, we know that 1.1 million people in Sweden feel they have impaired locomotion. Many of them have named specific disabilities; nearly 600,000, for example, reported that they have difficulty coping with stairs.

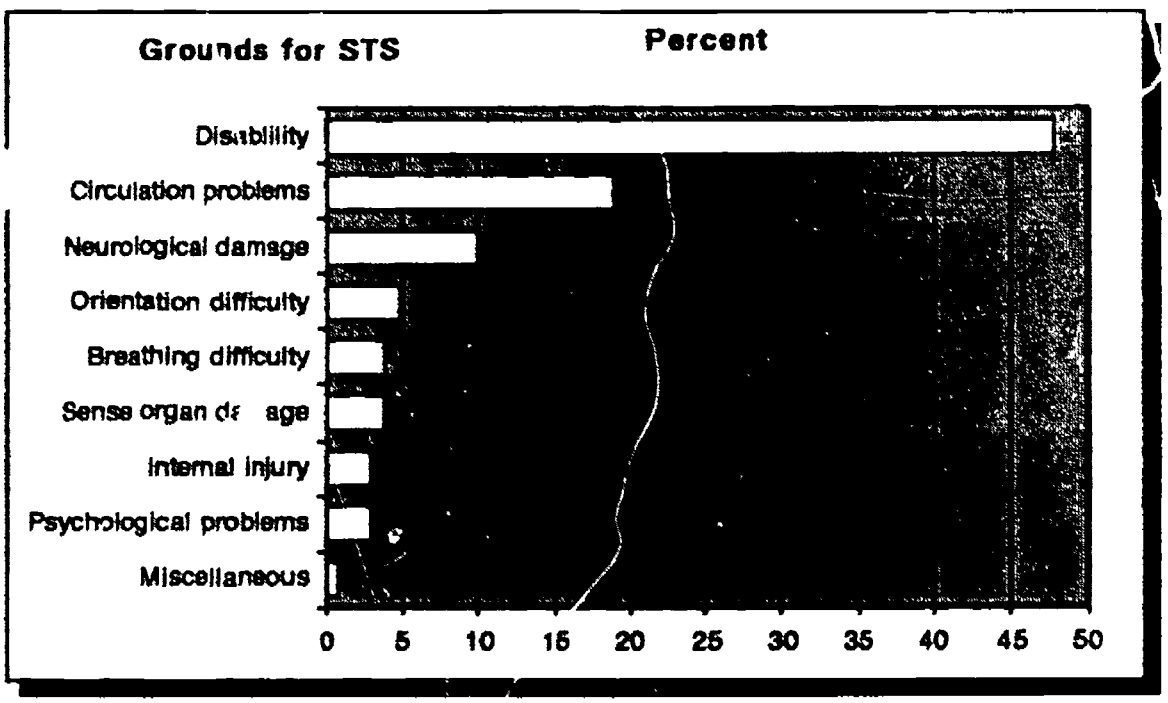
	Number (in thousands)	Amount (in %)
 **People without impaired locomotion**		
Able to run short distances	5,360	83
 **People with impaired locomotion**		
Unable to run short distances	1,132	17
 **Disabled people**		
Difficulty boarding a bus	378	6
Difficulty walking	465	7
Difficulty coping with stairs	590	9
Entitled to STS	233	4

Impaired mobility in the population between the ages of 15 and 84, according to the inquiry into travel habits RVU-78. (VTI 224:1981)

• People entitled to Special Transportation Services

According to RVU-78, ca 230,000 people were entitled to STS. In 1985 there were ca 360,000. The number of STS entitlements can, to a certain extent, be used as an index to which people have travel problems. The number of entitlements is of course easier to calculate than are the difficulties encountered by individuals.

An overall evaluation of the individual's ability to travel has been conducted for those who are entitled to STS. Physical, psychological, social and environmental factors play equal roles in the determination. Thus, the group of people entitled to STS also includes people who are not physically disabled. This can be illustrated by information from the Stockholm County Council, which has supplemented the medical causes in the STS statistics



Recorded grounds for Special Transportation Service entitlement in the county of Stockholm, 1984.

Hence, not everyone entitled to STS is physically disabled. On the other hand, disablement does not automatically mean that one is entitled to STS. Only about one-third of all people who have some form of disability or vision

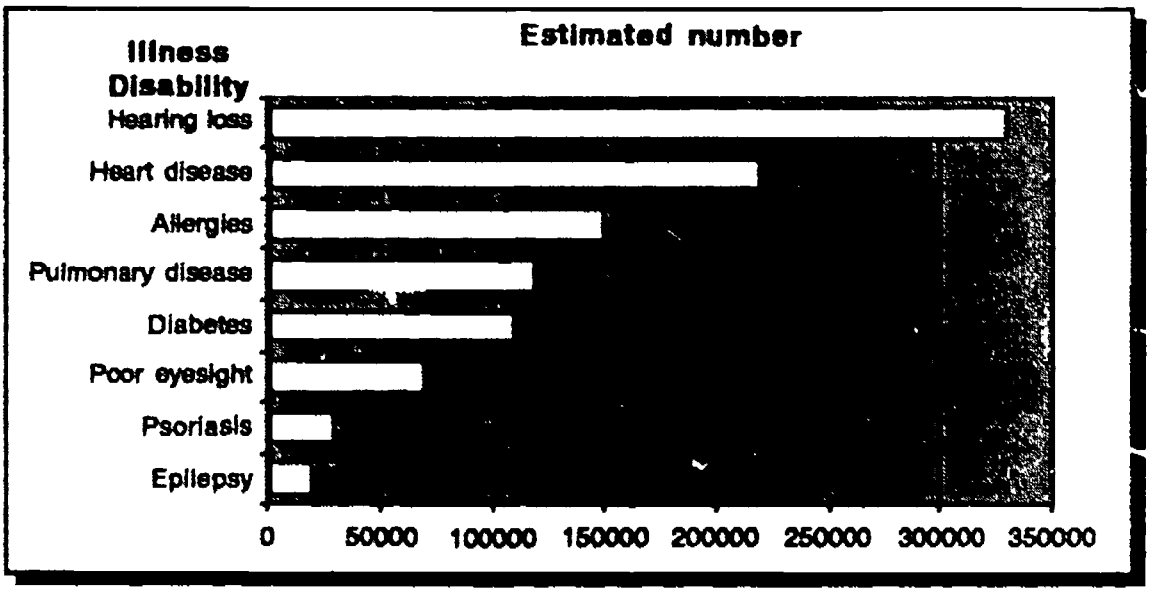
impairment have STS entitlement. The proportion is greatest among those over 75.

Since STS evaluations are dependent on many conditions, the number entitled to STS varies sharply. The probability of qualifying for STS increases with the severity of functional impairment. Another important factor is access to an automobile. Those who have a car at their disposal have significantly less entitlement to STS. Obviously, too, the number of people entitled to STS also varies according to different political judgements when the rules for STS are to be effected in the country's municipalities.

In the metropolitan areas of Stockholm, Gothenburg and Malmö, the proportion of people entitled to STS is larger than in the rest of the country. The greatest increase during the 1980s has occurred in cities of 50,000 to 100,000 inhabitants, but still there is a higher share in the metropolitan areas. In 1985, 33% of those entitled to STS lived in metropolitan areas, while they comprised 27% of Sweden's total population. (TFB stencil #26)

Region	Percent of disabled people entitled to STS	
	1978	1980/1
Stockholm	42.1	39.7
Gothenburg & Malmö	36 6	30.2
Big cities	20.7	18.0
Mid-size southern districts	14.8	20.2
Northern urban districts	17.7	28.1
Sparsely populated areas in the north	14.6	23.1

Percent of disabled between 16-74 entitled to STS. (DsFi 1982:2)



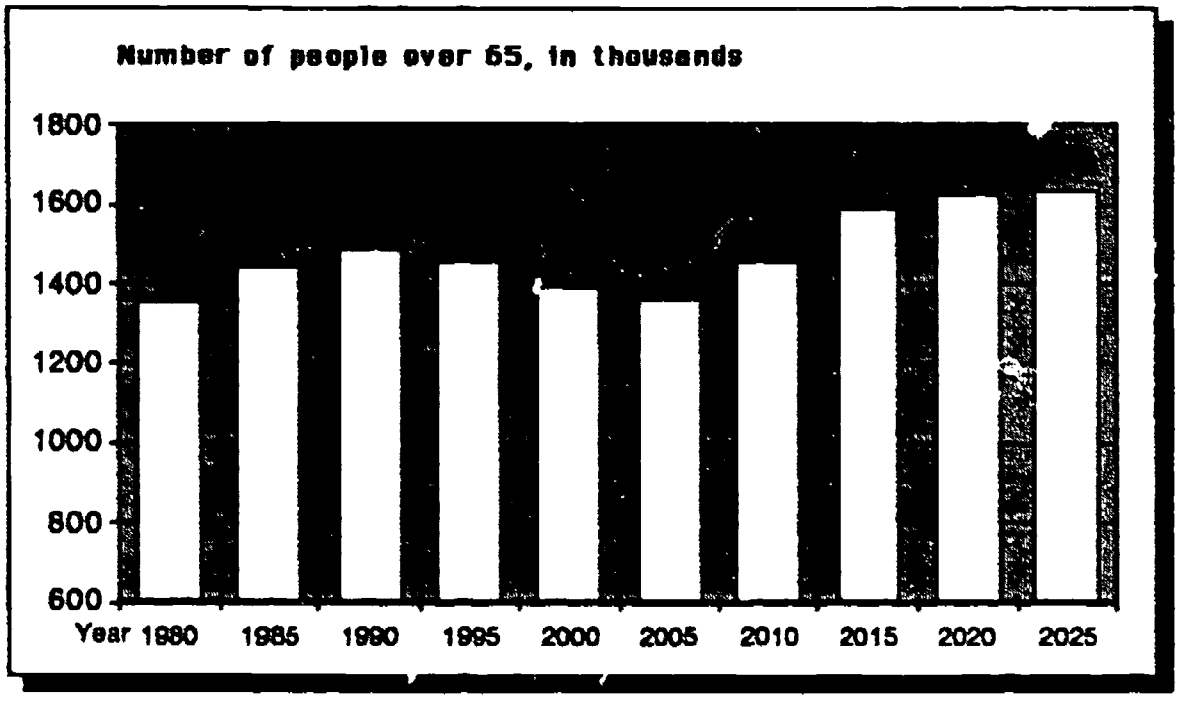
(SOS Living Conditions Report 41)

• Illness or injury

A third way to describe those who are disabled in traffic is to indicate what kinds of illness or physical injury characterize the group. A certain illness need not imply that a person has problems travelling.

• The elderly

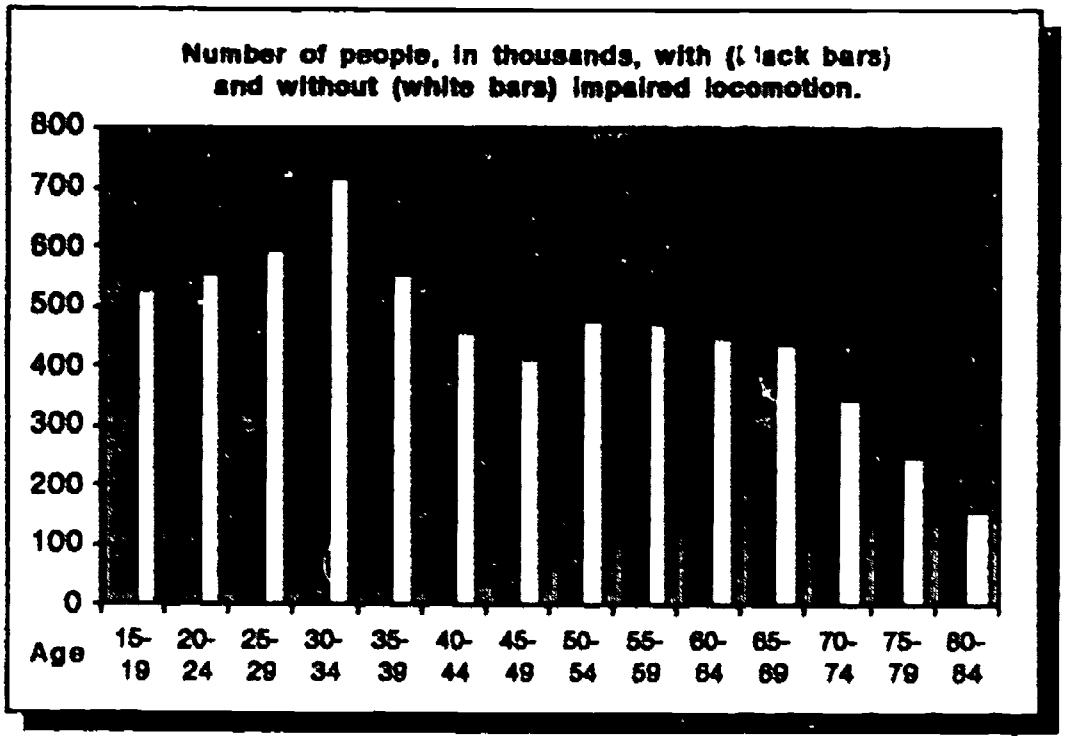
The number of people of different ages is easily accessible, and relatively easy to calculate for the future. The group of older people has increased significantly. The increase will not continue in an unbroken line, but there will be more elderly people, both in numbers and proportionally. The population will remain largely unchanged until the year 2000. The number of people over 65 will increase until about 1990, and then decrease somewhat up to 2010. Between 2010 and 2025, the number and proportion of the elderly will increase again; in 2025 they will constitute more than 20% of the population. The number and proportion of inhabitants over 80 will continue to increase to the beginning of the 21st century.



The number of people over 65 is expected to decrease after 1990, but to increase again after 2005. (SOS Forecasts 1983:2)

Since there is a strong connection between age and disability in traffic, the number of people entitled to STS, for example, has increased when the number of people of advanced age has increased. At the same time, we should remember that the rules governing STS have changed, which also impacts on the number entitled to STS.

The RVU-78 inquiry also indicates clearly that the proportion of disabled people also increases with age. Of those who report disability, ca 70% are over 65.



The number and percent of people with impaired locomotion increase with advancing age (VTI 1981:224)

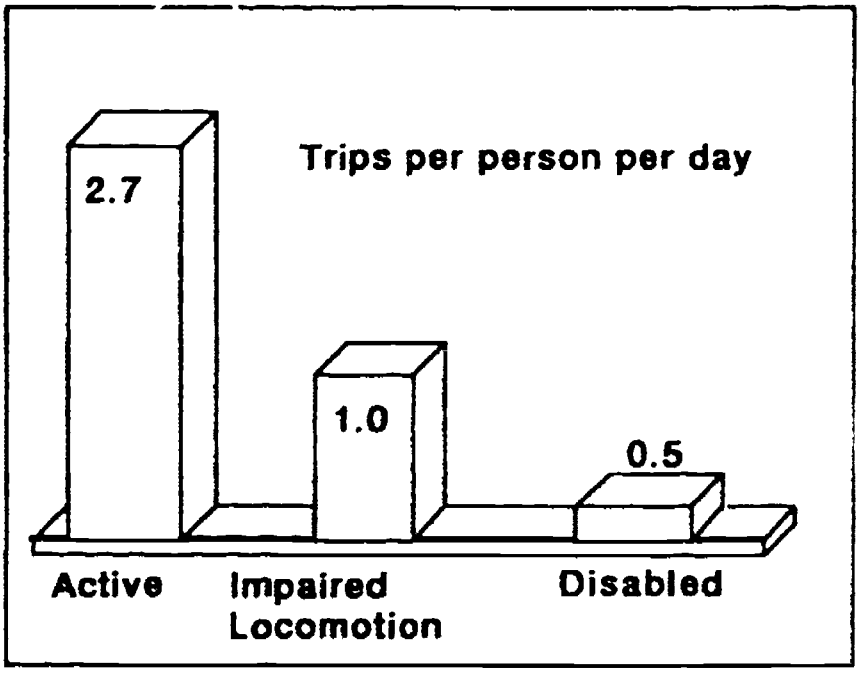
Older people who are entitled to STS experience themselves as more lonely, and in poorer health, than their coevals who are not so entitled. It is not possible, however, to document any greater differences in illness between the two groups. (TFB Memorandum #38)

3. Disabled people travel less Frequently than others.

The available statistics on travelling are, as a rule, based upon, or connected to, one of the four methods of estimating the number of traffic-disabled people described above: experiencing disability, STS entitlement, illness or age.

The experiencing of disability

Those people who are completely agile travel significantly more than those who have impaired locomotion or those who are disabled. Using the figures from 1978, disabled people on average leave their living quarters once every other day. The corresponding figures for those with impaired locomotion are once daily, and, for the completely agile, one-and-a-half excursions every day.



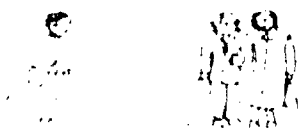
Active people travel more than twice as much as people with impaired locomotion and disabled persons combined.

Aside from the differences in the number of trips, there are also distinct differences in the means of travel. A permeating tendency is that active people have access to, and employ, several different means of transport to a greater extent than do the two groups with impediments.

Active people most often use a car for their transportation. The car is also an important means of transport even for those who have impaired locomotion, or are disabled. The proportion who travel as a driver or a passenger is 42% for those with impaired locomotion, and for the disabled, 33%.

The difference is even greater for the number of excursions by walking. For the totally active, walking accounts for only 20% of their outings. For the disabled, walking is the commonest means of getting about.

It may seem odd that people with impaired locomotion rely to such an extent on walking. That depends partly on the fact that all outings of more than 200 meters have been included, and partly on the fact that the elderly and disabled move about in their immediate neighborhoods much more than do other groups.



Group Means of Transport	Active	Impaired Locomotion	Disabled
Walking	20.2	34.8	42.7
Bicycling	9.2	5.2	1.4
Moped/Motorcycle	1.4	1.4	0
Car driver	43.7	25.6	10.5
Car passenger	13.4	17.0	23.1
Taxi	0.5	1.7	13.7
Bus	8.7	11.8	7.4
Train/Plane	2.9	2.5	1.2
	100.0	100.0	100.0

The commonest mean of transport for the disabled is walking.
(VTI 1981:224)

The problems confronted by elderly pedestrians can be divided into three main groups:

- Personal physical ability. People express the fear of being involved in an accident caused by their own physical limitations.
- The physical environment. People are afraid of falling because of badly maintained roads, holes, inclines, projecting objects, etc.
- Traffic. People are intimidated by sudden changes in the traffic pattern.

The reasons for travelling also vary. Active people are for the most part gainfully employed, and are therefore naturally involved in a number of business-related trips. If these are subtracted, the difference in trips decreases, but nevertheless remains.



Group	Active		Impaired Locomotion		Disabled	
Purpose	Number	%	Number	%	Number	%
Work	305	35	56	15	12	6
School	38	4	2	1	0	0
Business trip	86	10	14	4	0	0
Shopping	107	12	92	25	43	22
Service	18	2	18	5	11	6
Health care	8	1	12	3	12	6
Child care	4	0	0	0	1	1
Relatives/Friends	84	10	51	14	26	13
Leisure	160	18	99	27	73	37
Miscellaneous	74	8	26	7	20	10
Total	883	100	371	100	198	100

Number and percent of trips for certain purposes per person and year. (VTI 1981:224)

The travel habits of those entitled to Special Transportation Service

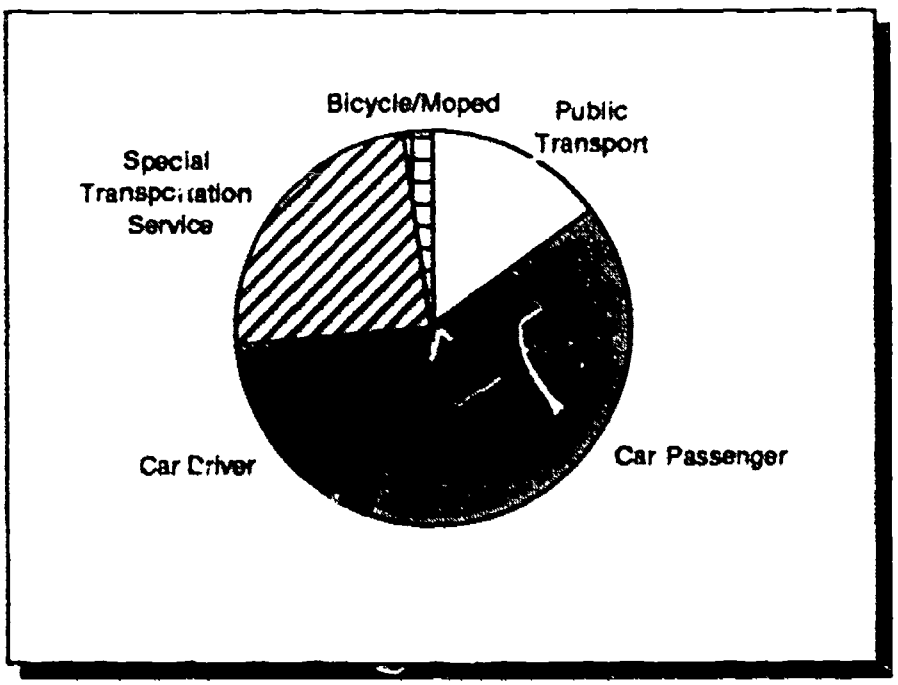
Travelling by STS varies with age. Up to the age of 40, there is an increase in the number of trips per year. Then the number decreases, until it becomes very small for those over 85. Among 85-year-olds, there are many who do not travel at all.

STS is not the only option for those who are entitled to it. The 1978 Travel Habits Inquiry showed that STS was used on average for only about 25% of the day-to-day trips by those who were entitled. Trips by car, as passengers and as drivers, are more common than STS trips among those who are entitled to STS. Trips by car account for 60% of the travel by this group. 6% of those entitled to STS have their own car, and a good 20% have access to a car in the household.

Fifteen percent of the people entitled to STS travel by public transport, which is about the same figure as for the total population of Sweden. Variations among those so entitled are, of course, great, especially when their travel habits are viewed over the course of time. Much of the debate over the future of STS has focussed on the connection between travel by STS and by public transport. If municipal public transport is gradually made more accessible to people who use STS, will they use it to a greater extent than at present?

The observation that STS travellers have widely varying abilities and inclinations to use other means of transport has led to conflicting points of view. One attitude is that the number of STS travellers has become too large, and that many so entitled can get along without it. This leads to the demand for more restrictive granting of entitlement.

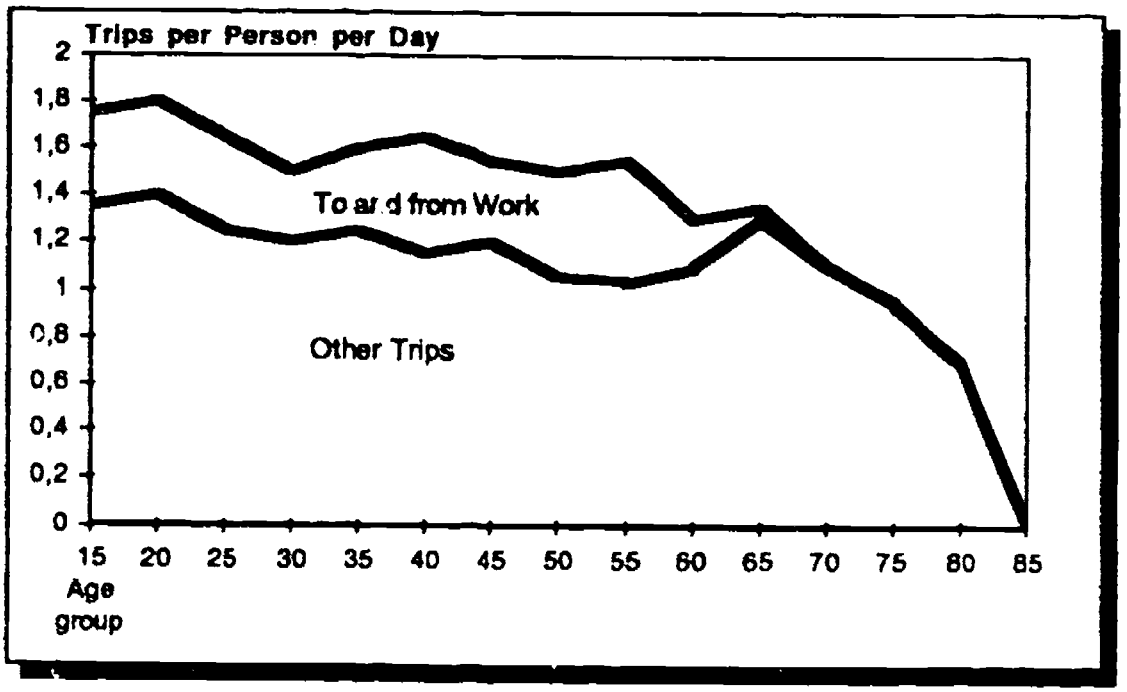
Another attitude is that it is not the number of travellers that is decisive, but rather how much each person travels. As public transport becomes more adapted for handicapped people, and as car ownership increases, the objective should be to encourage travelling by means other than STS.



Daily travel by people entitled to STS distributed according to means of travel. (TFB stencil Nr. 26)

The travel habits of the elderly

At first glance, it would appear that increasing age implies decreased activity. However, the statistics are strongly influenced by trips connected with employment. Subtracting trips to and from work and school, as well as business trips, reduces the difference significantly (VTI 1981:224) We see clearly that increased age does not automatically entail less travelling. Travelling decreases palpably only after age 75. Older women, as a rule, travel considerably less than men, and they begin to decrease their travelling earlier than do men.



Travel tendencies for trips to and from work and other trips by people of different ages, 1984/85 (TFB Memorandum Nr. 45)

In general, the number of trips, their length, and travel time decrease as the degree of disablement increases.

For older people, there are six decisively important factors involved in travelling:

People with impaired mobility and their travel needs.

Disability	An increased degree of disability results in fewer trips
Gainful Employment	Employed people travel more than others.
Sex	Men travel more than women.
Car Ownership	Car owners travel more than those who do not own cars.
Public Transport Standard	People who have access to a high standard of public transport travel more.
Couples	People living together can take turns shopping.

Resurser och resor [Resources and Travel], Vilhelmsson 1985.

4. Travel by the Disabled Is on the Increase

There are many circumstances that point to a marked increase in the travel needs and demands of the disabled. For several years, personal travel in Sweden has been on the rise. Current prognoses indicate a steady increase, and the whole society is planning and investing for a coming society based on greater geographical mobility. The structure of society continues unabatedly to become more and more dependent on transport. The locating of residential areas, peripheral shopping centers and even work places tends to be oriented to car ownership.

Another important factor that influences travelling is that institutional residence is decreasing. Previously, most disabled children lived in large institutions, with schools and recreational facilities near by. Presently, they are increasingly integrated into schools and recreational facilities located in many places. Elderly people are also living at home to a greater extent, and one result is an increased number of trips to care centers, etc.

We find the largest group of disabled people among the elderly. Although the number of older people can easily be counted, it is not as easy to tell how travelling is going to develop. Today's newly retired people have a more active lifestyle, better finances and greater access to a car than used to be the case. There will also be changes within the group of retired people. The aged, people over 80, will increase from 310,000 in 1985 to 385,000 in the year 2000.

The number of older people with a car is increasing.

The greatest change in the immediate future will be the increase in the number of older people who have cars. Their travelling will be altered by this marked increase in car ownership. In 1978, ca one-third of the elderly had a car in the household. Six years later that figure had increased to 45%. By the turn of the century, fully half of the elderly will have access to a car. Similarly, the proportion of trips by the elderly using a car increases during the same period. According to one future estimate, car travel by the elderly will increase by 30% while their use of public transport will decrease by 25%. This trend may be strengthened as pensions are improved. (TFB Report 1986:2)

Car ownership increases as a result of enhanced economic development. Above all, a significant equalization between men and women is anticipated in this respect.

Income is increasing faster among women than among men as a result of more equal pay standards and the growing number of women gainfully employed. The income flexibility among women for car ownership is nearly 100% greater than among men. It is expected that this will result in a significant increase in car ownership among women.

Development of car ownership in the future according to VTI

	1985	1990	1995	2000	2005	2010
Men	67	68	69	69	69	70
Women	21	24	27	30	32	35

Car ownership and possession of an operator's licence vary, not only between men and women but also between regions. The largest numbers of people who lack cars and licences are to be found in Gothenburg and Stockholm. (TFB Memorandum Nr. 30)

Car ownership and possession of an operator's licence vary, not only between men and women, but also among regions. The largest proportion who lack a car and a licence is to be found in Stockholm and Gothenburg. (TFB Memorandum #30)

The conclusion to be drawn is that a large number of elderly people will satisfy their increasing travel needs by recourse to their own automobiles. Hence, travelling by public transport and municipal STS can decrease. This may, however, be counterbalanced by an increase in the number of very old people in society, which can in turn lead to an increased need for STS involving special-purpose vehicles.

Means of Transportation Designed for the Disabled

5. Special Transportation Service (STS) Is the Most Important Means of Transport for the Disabled

The traffic problems faced by the elderly and disabled can be rectified in different ways. A number of physical obstacles can be eliminated, and difficulties using public transport can be reduced. What will remain is special solutions for severely disabled people who cannot get about on their own using ordinary means of transport. There are about 20,000 people in this group. There is a considerably larger additional group for whom travelling will remain difficult until such time as obstacles have been eliminated. They require special means of transport that are adapted to the problems caused by their surroundings and the traffic system.

The solutions existing today, which have been especially contrived to permit travel by the disabled, include municipal STS using taxis or special-purpose vehicles, national STS, Service Routes, and subsidies for individual trips by car. In addition, a small number of disabled people can manage their shorter trips in specially designed wheelchairs.

The use of these various solutions depends on the various requirements of disabled travellers.

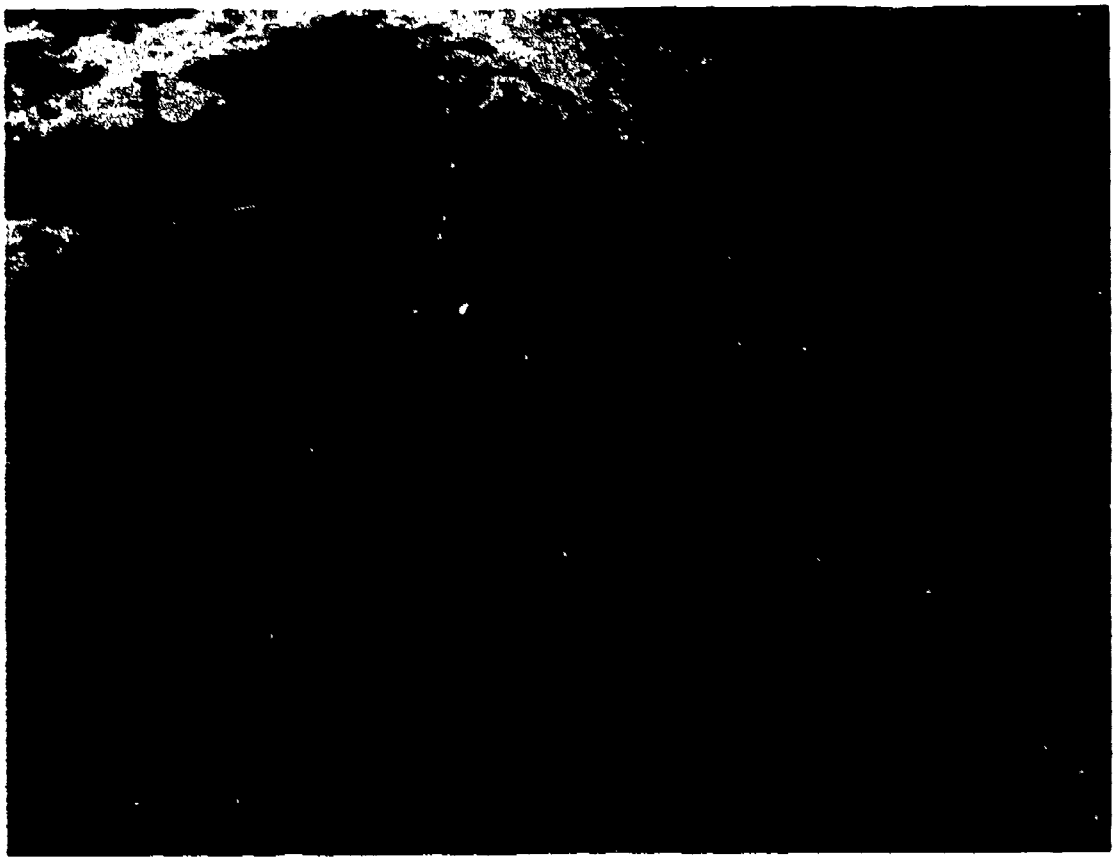
Transport Need	Sample Solution
door-to-door	taxi & special vehicle
driver assistance	taxi & Service Route
personal trip	taxi & special vehicle
special equipment in vehicle	special vehicle or modified private vehicle
short walking distance	Service Route in the vicinity

Taxis are the commonest means of travelling with STS

The clearly dominant means of travel for the disabled is taxis paid for by municipal or national STS. Taxis are almost

always ordinary passenger cars that are difficult to get in and out of, and that are not particularly adapted for the disabled. The taxi is not, in reality, a means of transport especially intended for the disabled. It is a flexible solution that meets the requirement of door-to-door transport, assistance for the passenger and the need to travel in "one's own" vehicle. Special equipment for transporting the disabled is seldom found in taxis.

The main thing one can say about STS trips by taxi is that they are economically subsidized, since travelling by taxi is available to everyone, and not particularly adapted for the handicapped.



People entitled to STS usually travel by taxi, even though such vehicles generally are not adapted to meet the requirements of disabled people.

Municipal STS

STS was introduced in many municipalities at the end of the 1960s. Since then, it has expanded greatly; in 1985, approximately 360,000 people were entitled to STS. That amounts to 4% of the total population, and 19% of those over 65. It also means that municipal STS is one of the commonest forms of social assistance for the elderly and disabled. Compared with other countries, Sweden has a very large number of people entitled to STS. In Stockholm, for example, ca 80,000 people have STS, compared with 4,800 in Copenhagen.

Who receives STS, and how it is organized, are local, municipal decisions. In ca 90% of the municipalities, the awarding of STS is governed by the recommendations of the Association of Local Authorities. This implies that a person must have considerable difficulty using ordinary public transport. Inasmuch as conditions vary among municipalities, there are also variations in the number of people entitled to STS per inhabitant or per age group. There are also large variations in the rules governing payment and number of trips by STS. (Ståhl 1983, Färdtjänst i kommuner [STS in municipalities])

Passenger fees for trips by STS

The fare paid by the STS passenger is calculated according to three basic principles.

1. The passenger pays a certain part of the amount on the taxi meter.
2. The passenger pays the public transport fare.
3. The passenger pays a fixed fee per single trip.

The tendency during the 1980s has been that municipalities have increasingly abandoned the fixed fee per trip, and gone over to a percentage of the metered fare. The other important change during the 80s is that the level of fares has risen.

The commonest payment system used today is 20% or less of the metered fare, or a certain percentage of that fare in combination with a fixed fee. This means that most STS passengers pay a fee that is directly dependent on how far they travel. The costs for those entitled to STS are of the same magnitude as the costs for a private automobile.

About 10% of municipalities use the public transport fare. This can be viewed as an effort to put STS in the same category as other public transport. (TFB Memorandum #58)

In the short run, travelling by STS seems to be influenced by the fee. In the long run, however, it is not certain that the price influences the number of trips. Studies in several municipalities indicate that travelling declines with increased fares, and vice versa. Those municipalities that use the public transport fare as the system for payment have, on average, more trips per person entitled to STS than do the others. However, it is mainly the large cities that use this system, and differences among cities may contribute to the differences in travelling. Entitlement to STS is higher, and there are more trips by STS, in metropolitan municipalities than in smaller ones.

Rules governing numbers and lengths of trips

Most municipalities have an unlimited number of trips for STS passengers within the city limits, sometimes with certain restrictions regarding length of trip. The municipality is an administrative boundary that comes into conflict with many travel needs. The administration of dispensations that results can sometimes consume the savings made by imposing restrictions. One-third of all municipalities have restrictions on the number of trips, on costs, or on trip length. All municipalities impose restrictions on trips beyond the city limits. (Ståhl 1983, Färdtjänst i kommuner, TFB Memorandum # 58)

Special-purpose vehicles

A small portion of STS trips is made in special-purpose vehicles. They are usually booked and carried out like taxi trips, but the vehicles used are more or less adapted to accommodate wheelchairs. During the early 1980s, the share of trips by special-purpose vehicle has been less than 7%. More recently, different coordination systems have had the effect that even those who do not actually require such service have been transported when their travel plans coincided with the dispatch of a special-purpose vehicle.

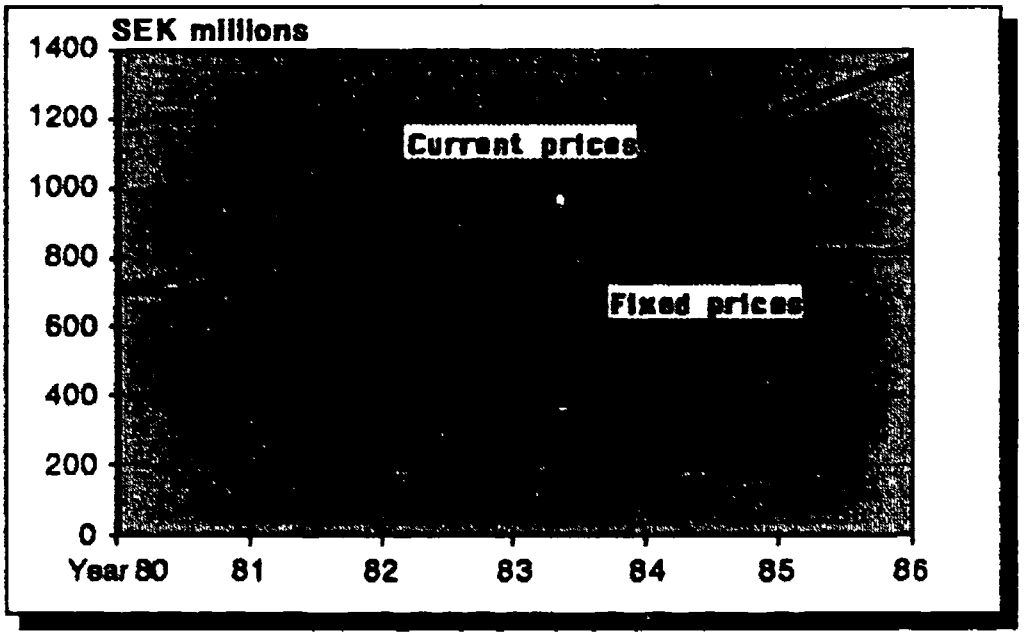
The special vehicle is usually operated by one person. In that case, lifting assistance has to be summoned if there are stairs or other obstacles necessitating carrying the wheelchair passenger. The personnel see this as the most difficult aspect of the job. Even locking the wheelchair in place in the vehicle is a problem, since it must be done in a squatting position.

Picking up a passenger and moving him or her to the vehicle takes an average of 4 minutes, while hoisting and locking take 2 minutes, according to studies in Gothenburg.

Different ways to reduce the costs of STS

Municipal STS is financed in three different ways: fares paid by the passengers, municipal taxes and national subsidies. For the country at large, the share covered by fares has been estimated to be 16%. National subsidies amount to a maximum of 35% of the gross cost; the rest is made up out of municipal taxes.

Since costs have gone up, primarily because of the growing number of STS passengers, many municipalities have sought to hold down the cost increase in different ways. The commonest measures are tighter restrictions on awarding entitlement, higher fares, ride sharing and booking routines. In some places, there have also been experiments with simplified administrative procedures. Between 1977 and 1984, various measures have resulted in lower costs, both per single trip and per person entitled to STS, as measured in fixed prices. (TFB Stencil # 26)



STS costs in current and fixed prices. Calculated in fixed prices, the cost has increased by ca. 17% in six years. In current prices the increase is 100%. (TFB Memorandum Nr. 58)

Tighter restrictions on award of entitlements

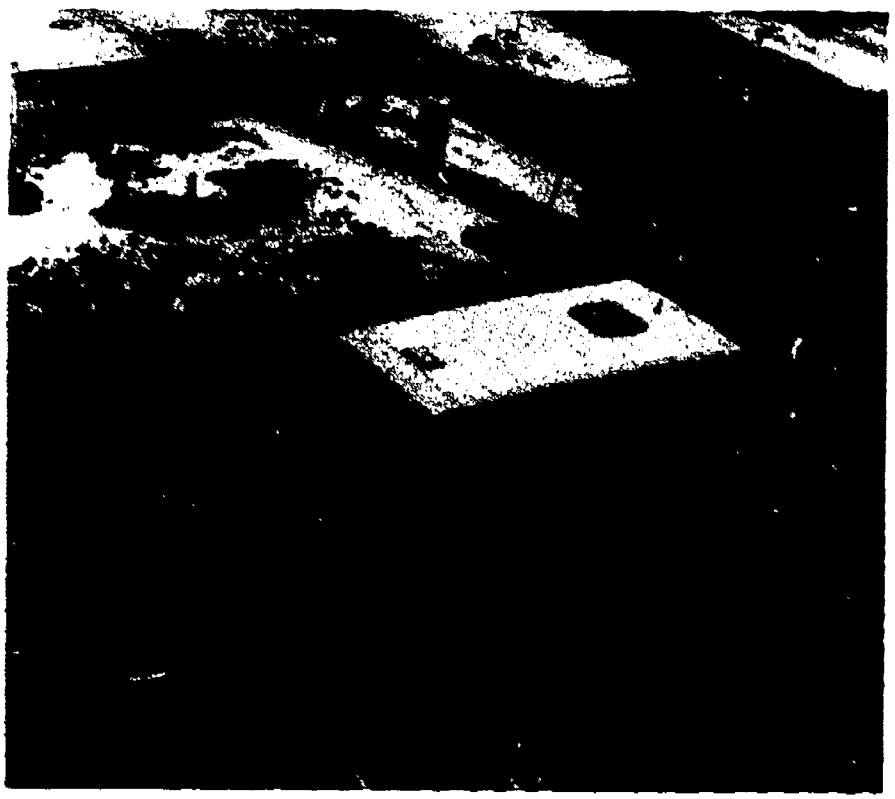
Responding to a questionnaire in 1983, 12% of the municipalities said that they sought to reduce costs by being more restrictive in awarding entitlements. The restrictions employed are to require a doctor's certificate, to visit the person at home, and to put a time limit on entitlement to STS.

Higher fares

Between 1979 and 1984, the fee paid by the STS passenger rose from 9% to 16% of the gross costs. Fare increases vary greatly among municipalities.

Ride sharing

In 1983, fully 50% of the municipalities had various methods of coordinating STS trips so that several people rode in the same vehicle. Ride sharing has been organized to a greater extent in those municipalities with a fixed fee for single trips than in other places. The practical coordination is normally handled by the local taxi company, the fire department, or a special booking agency. Some studies show that passengers generally respond by reducing their travel when coordinated trips are introduced. Booking in advance and ride sharing are viewed negatively. (Ståhl 1983, Färdtjänst i kommuner)



STS trips using special vehicles are often coordinated.

Booking in advance

Effective coordination usually requires a certain amount of lead time. Most municipalities that have coordination require booking trips in advance. Usually, the trip must be booked a day ahead, but there are both longer and shorter booking requirements. Studies in Malmö and Skellefteå indicate that booking routines occasion the greatest problems for STS passengers. (Ståhl 1986, Att vara äldre i trafiken [Elderly people and traffic])

Coordination management: by the passengers themselves, by the local taxi company, or by a special agency.

In 10 municipalities, those entitled to STS must themselves coordinate their trips. In Piteå, experiments in sparsely-populated areas have shown that good results can be achieved when the passengers handle the coordination themselves. For this to succeed, there must be advantages for the passengers, the municipality and the transportation company. (TFB Memorandum # 24)

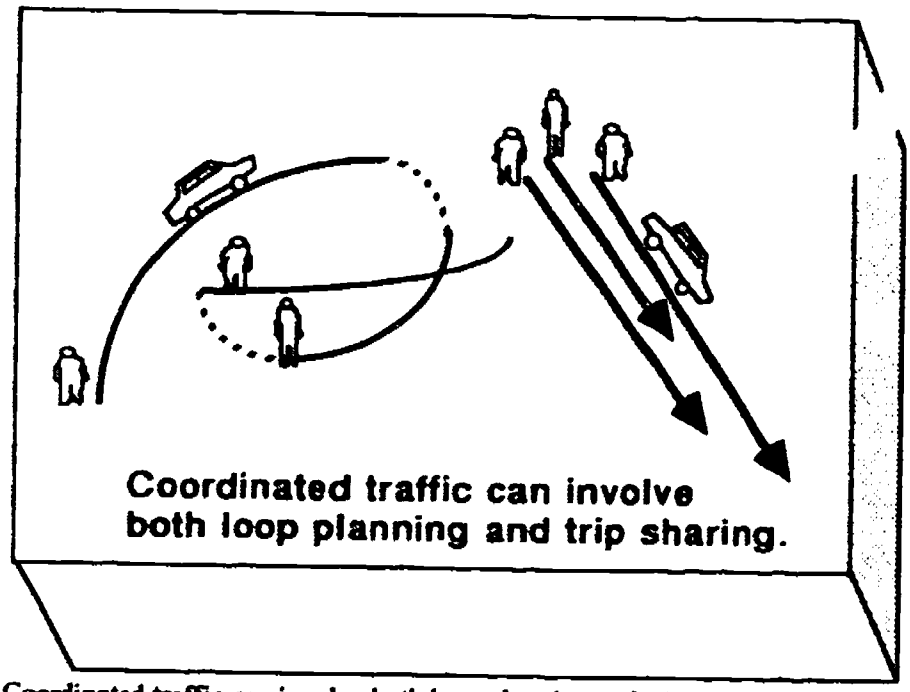
In 1983, coordination in 39 municipalities was handled by the taxi companies. The companies often managed to coordinate trips in their special-purpose vehicles.

In Ludvika, manual coordination and traffic planning were carried out to see whether savings could be achieved by coordinating sickness and STS trips. The result -- 13% of trips coordinated -- corresponded to about one-third of what had been anticipated.

In 1983, ride sharing had not shown any significant effect on the cost per trip or per STS passenger in those municipalities who had tried it. One plausible reason may be that ride sharing had not been in effect very long when the investigation was made. Some studies in 1986-87 still showed that coordination would not be a simple way of reducing costs. On the contrary, in several cases the costs of coordination have been greater than the profits.

Computerized coordination

There are better conditions for ride sharing in large urban areas than in sparsely-populated ones. Partly, it is easier to find more people travelling in the same connection, and sometimes, the vehicle can be dispatched in a loop to increase occupancy.



Coordinated traffic can involve both loop planning and trip sharing.

Efficient coordination requires many trips booked in advance that can be coordinated and looped. Together, these factors produce so many bits of information that computerized coordination is probably the only solution.

In Stockholm, for example, a computerized system for coordinating transport by special-purpose vehicle has been in effect since 1982. Malmö and Borås have computerized coordination of all STS trips. The coordination system at the booking agency in Borås has demonstrated that savings from ride sharing and tour planning can amount to nearly 20% of the total taxi cost of STS.

The Traffic Research Board has lent support to a large project for developing an advanced general system for planning and administering publically financed transport. The objective of this large project was to develop technical solutions, both for communications between the booking agency and vehicles and for coordinating trips. It has been partially installed in Örebro.

The computer system at the booking agency checks its register of people entitled to STS to ascertain how far one person can travel with others. The system plans the ride sharing within a certain trip interval, which the customer must observe. The tour planning is managed so that people going the same way travel together. The dispatching is organized

around optimal occupancy, and an appropriate vehicle is chosen. Dispatching occurs automatically and is printed out in the vehicle.

The equipment in the vehicle consists of a registering fare meter with a printer and a credit card scanner. By providing all STS customers with a combined identification and credit card, STS trips can be registered when the card is drawn through the scanner. The accumulated information is deposited in a computer central which manages the bookeeping, statistics, etc. (TFB Stencil # 26)

The smaller systems, as a rule, only handle administration of bookings and assist in coordination. Evaluations of computer assistance show that a large proportion of trips are coordinated, and th STS costs can be reduced. There are no studies, however, that have investigated the profitability of the total investment and the overall coordination enterprise.

Free public transport for people entitled to STS

Those entitled to STS do a lot of their travelling by ordinary public transport. Several municipalities encourage this by offering free travel, hoping to decrease the numbers of STS trips by taxi. The discernible result is that people entitled to STS do use public transport more when they do not have to pay for it. What is not clear is whether they travel less by taxi. A certain reduction of taxi trips has been achieved in Skellefteå, where advanced booking is required for STS trips and bus travel is felt to be easier.

The other effect of free public transport for STS passengers is an increase in the number of applications for STS. The service is more attractive when one can receive both subsidized taxi trips and a certain amount of free travel. (TFB Memorandum # 58)

Simplified administrative routines

Handling the accounts for Special Transportation Service is a very wide-ranging and time-consuming process. Therefore, the municipality of Linköping has purchased all of its STS from the taxi company for a fixed sum. This solution has greatly reduced the work of writing out receipts, billing and supervision. Another way to facilitate administration is to provide taxis with meters that write out receipts and keep records. That means that all the handling of receipts can be eliminated, and that accounting can be both faster and more reliable.

6. National and County-wide STS Facilitates Travel Beyond the Parameters of One's Own Municipality.

Municipal STS applies mainly to travel within a municipality. This creates obstacles for residents who live near the city limits, and for travel in the surrounding region. Of course, national STS for longer trips within the country has been in existence since 1980. Its purpose is to make it possible for severely disabled people to travel at normal fares. There are about 20,000 people who qualify for national STS. Only about 5% of those entitled to municipal STS use national STS. Hence national STS is no solution for the large group of people entitled to STS who want to travel within a county, or even just between two neighboring municipalities. This is an ordinary kind of travelling. Every fifth national STS trip is within the boundaries of the passenger's county, and 75% of county-wide trips are shorter than 100 km (ca 60 miles).

Most national STS trips -- 75% -- are by taxi or special-purpose vehicle; 20% are by plane, and 5% by train. There is virtually no bus travel involved in national STS. People using national STS prefer modes of transport that provide personal assistance. One-fifth of those entitled to national STS were also granted the possibility of taking along an attendant without charge.

County-wide STS

County-wide STS was introduced in Östergötland in 1987 to facilitate regional travel. The premise is that county-wide STS will imitate regional public transport, the difference being that it must be booked in advance. Another important consideration for creating county-wide STS is that most STS customers can travel by bus and train if they have assistance. The county-wide STS journey begins with a taxi ride from residence to bus terminal or railway station. There the taxi driver and/or bus driver helps the passenger change vehicles. This exchange takes place at the route terminus, to avoid interfering in normal route operations. This also applies to changes between routes. At the end of the journey, another taxi drives the passenger to the final destination. An evaluation of county-wide STS in Östergötland is underway and is expected to be completed in 1989.

7. Service Routes Are a Form of Transport for the Disabled that Functions for Everyone

Service Routes are bus traffic that is available to everyone. Unlike ordinary public transport, planned for healthy people and then, if necessary, adapted for the disabled, Service Routes are designed from the start to accommodate the needs of the elderly and disabled. They can thus be defined as transport for the disabled. Service Routes run close to residences and destinations that are important to the elderly and disabled, such as care centers, clinics, hospitals and the downtown area. The timetables are also planned to allow plenty of time for elderly and disabled people to get on and off the bus. The vehicles used are small buses, adapted for disabled passengers, and capable of driving in close to the destination.

It is frequently hoped that the demand for STS by taxi will be reduced through the introduction of Service Routes. They cannot, however, entirely replace STS, because elderly and disabled people do not all live in the same area. The initial routes can be laid out between areas with a large proportion of older people and the destinations most important to them, which will assure satisfactory passenger use. The more routes introduced, the more difficult to plot them so that they suit the needs of those one wants to serve and, simultaneously, assure occupancy that will make Service Route transport cheaper than individual travel.

Important components for a Service Route are:
- short distances to the bus stops
- convenient boarding and debarking
- small vehicles with good railings and armrests
- comfort and service while travelling
- security and social intercourse.

It has been demonstrated in Borås that, in areas with Service Route traffic, public transport is used by more elderly people, and more often. The problems of taking the bus have been drastically reduced. In one area studied in Borås, the proportion of public transport passengers has risen by 11%. Service Route traffic accounts for virtually the entire increase. Over half of the elderly people in the area who travel by traditional public transport report difficulties in using it. Service Route traffic reduces the difficulties by 75-80%. Fewer than 10% of public transport passengers report

problems when they travel by Service Route. The study further shows that older people who are not so severely disabled as to require STS are apparently able to travel almost entirely problem-free in Service Route traffic.

A certain transfer of STS passengers to Service Routes can also be observed, and this in turn has a favorable economic effect. The study estimates that STS costs can be reduced by 20-25%.

The Service Routes in Borås are laid out around destinations that are important to the passenger group for which they were created, like the downtown area and clinics.

Service Route traffic is an important part of municipal public transport. An expansion of the traffic network with Service Routes is regarded as one link in an ongoing adaptation of the entire public transport system in Borås to better serve the customer. (TFB Memorandum #42)

8. Disabled People Often Travel by Private Automobile

According to a number of studies, the dominant share of travel by disabled people is by private cars. Some of them are drivers; most are passengers. These trips are not as a rule adapted to the needs of the disabled, but rather employ ordinary private cars. Hence, the largest number of people who have impaired locomotion drive or travel by ordinary car. Studies of taxis prove that the functional measurements for meeting the needs of disabled people are not met by any standard automobile. Some cars' front doors do meet the measurement demands for height and width. No car meets the combined requirements for the height above ground of both door opening and seat. (TFB Memorandum #5)

About 30% of the people over 65 in Malmö and Skellefteå who have operator's licences have stopped driving. That proportion increases with increasing age. The usual reasons given for no longer driving are feelings of insecurity and physical impairments. (Ståhl 1986, Att vara äldre i trafiken [Elderly people and traffic])

About 50% of the elderly in Malmö and Skellefteå who have stopped driving have given physical impairment as the reason. There are, however, no studies indicating what steps must be taken to reduce the problems of disabled people in using private cars.

Automobile subsidies

Fully 10,000 people have subsidies, either for buying or for adapting a car to the driver's prerequisites. Individually adapted and equipped private cars are important assets for disabled people. A research and development project primarily to develop and improve servo-assisted accelerator and brake systems has been carried out at the Department of Disability Research in Gothenburg. This project has demonstrated that it is possible to find solutions that can be adapted for people with widely varying disabilities. (Brattgård et al 1976-85)

Adapting Public Transport Facilities for the Disabled

9. Public Transport Must Be Adapted to the Needs of Disabled People

The old word for "bus" is "omnibus," and it means "for all." Public transport should be available to everyone. That is not, however, the present situation. Large groups of people are excluded because of route layout, timetables and vehicle design. This means that many people are unable to participate in the fellowship of society and are not provided with the same living conditions as other people. One way to reduce this problem is the adaptation of public transport to the needs of the disabled, and avoiding a permanent cycle of specific solutions for disabled people.

Specific solutions for the disabled or traffic solutions for everyone?

One important trend in public transportation today is a division of route networks and service for different groups of customers. The railway has, for example, divisions for Intercity, long-distance and local trains, with different kinds of service and operations. The airlines offer choices including red departures for cheap flights, or taxi for door-to-door service. Bus traffic has begun to divide up route networks to provide fast, direct bus service to work for certain groups, and winding evening runs that provide service at many stops but involve slower trips. Public transport is in the process of being divided into different kinds of traffic to meet the travel needs of different groups. Service Routes are one of these solutions that have appeared for a particular group. This division of route networks for different groups of customers is one way for transportation companies to provide good service at a reasonable cost. (TFB Memorandum #25)

When traffic is divided according to the desiderata of different groups, it is difficult to decide whether this is a specific solution or an adaptation of general public transport. The Service Route, for example, is a specific solution because it primarily considers the travel needs of the disabled. At the same time, it is also adapted public transport since it is available to everyone. For people with severe functional impairments, specifically designed modes of transport are necessary. The

great majority of people with impaired locomotion, however, can use public transport if it is appropriately adapted.

Following the investigative activity of the 1970s, a law was passed in 1979 mandating the adaptation of public transport for the disabled. An extensive development program was carried out in the period 1980-84, designed to produce a foundation for practical adaptation measures. Most of the work has been devoted to vehicle design and studies of various ways of adapting existing vehicles. Four handbooks have been prepared, based on the requirements of people who are disabled, who have poor eyesight or hearing loss, etc., one for each mode of transport: bus (TFD 1982:13), train (Brattgård & Petzäll 1984), plane (Brattgård & Petzäll 1984) and boat (TFD 1983:11). Studies of the adaptation of taxis are underway and have resulted in subreports. (TFB Memorandum #5) These handbooks have largely provided the basis for the regulations concerning adapting public transport for the disabled.

According to the ordination for the adaptation of public transport for the disabled, the Swedish Board of Transport, Transportrådet, is responsible for promulgating the regulations for the adaptation. The regulations, the first edition of which appeared at the turn of the year 1981/82, apply to the adaptation for the disabled of buses, suburban train cars, trolley cars, subway cars, railcars, boats and planes (TPRFS 1985:10, TPRFS 1988:2). Both new and older vehicles are to be adapted. The demands are not as stringent for the older vehicles, and the transportation companies are allowed several years to make the changes. The older vehicles are to be ready by certain dates during the period 1989-1992. Many of them, however, will still be in service, with their limited modifications, even after these points of time.

The regulations are reviewed regularly, and can thus make use of the results of technical developments. After a one-year trial of the so-called kneeling system to reduce the height of the entrance step in buses, the system was introduced into the regulations as an alternative to fold-out steps. Hoists for wheelchairs have also been developed, eliminating the need to exempt new buses from the requirement of at least having the potential to be equipped with lifting devices for wheelchairs.

It is not only vehicles that require adjustments, however. Some projects have called attention to terminals and stops, and to the need for service and assistance in different situations while travelling. The previous ordination, with regulations

requiring transportation companies to gradually modify modes of transport for the disabled, was complemented with the availability of government grants by the traffic policy decision in the spring of 1988. Subsidies can be applied to the costs of modifying the vehicle so that it exceeds the specifications for accessibility. Grants are also available for terminals and stops for improvements that exceed the prescriptions in the Planning and Building Law. This availability of subsidies can be viewed as a stimulus to introduce measures beyond what is generally stated in the regulations.

Problems associated with public transport

The problems experienced by the elderly and handicapped in connection with public transport are many and varied. When discussing the problems associated with public transport, it is important to remember to consider all the links in the travel chain.

PROBLEMS	REGULATIONS
- Problems on the way to and from the bus stop:	
• Difficult stairs on the way to the stop	
• Bothersome traffic	
• Long walking distance	
• Slipperiness	
- Problems at the bus stop	
• No protection from the weather	
• No seats	
• Uncertainty re: departure times & destinations	
• Difficulty knowing which bus is arriving	Route number & destination sign
- Problems connected with boarding/debarking	
• The step into the bus is too high	Step height and depth; anti-slip.
• The bus doesn't pull in to the curbstone	
• Nothing to hold onto when getting on and off	Handles, railings
• Problems when paying	A support to hold onto when paying
- Problems during the trip	
• Difficulty finding a seat	Designated seats with handles and supports
• The bus starts before one is seated	
• Jerky driving	
• Uncertainty about when to get off	Next-stop announcements; stop signals
• Crowding on the bus	Space for wheelchairs and preparations for hoisting wheelchairs

The regulations govern only some of the problems that can confront the elderly and disabled.

10. Adaptation of Buses, Trains, Planes, Boats and Taxis

The regulations about the adaptation of public transport for disabled people deal solely with the adaptation of the vehicle. They are largely based on the results of different research and development projects. Hence the regulations can also be viewed as a summary of certain research results. Many of the results and recommendations of various investigations have not yet resulted in regulations. However, these findings may be employed in future regulations, or as guidelines for improvements for which the transport companies can receive government assistance.

Bus

Buses account for the largest share of public transport, and it is bus traffic that has been the subject of most of the studies undertaken to date. We therefore present here a more detailed account of the contents of the regulations published in July, 1988.

Collected Statutes of the Swedish Board of Transport TPRFS 1988:2

Buses of model year 1989 and later that are intended for 13 or more seated passengers will be adapted for the disabled as follows:

Route number and destination sign
The route number and destination will be announced on the front of the bus and at the entry door. The numbers will have a minimum height of 200 mm on the front, and 160 mm otherwise, and be visible in the dark.

Stop announcing
Stop announcing must be possible for every stop. It must be done audibly for those with poor eyesight, and by means of suitable signs or hearing loops for those with hearing loss.

Signalling devices for debarking
Easy-to-use signalling devices will be installed at seats for disabled people.

Steps
The step height at the entrance door will not be higher than 230 mm. The step depth will be at least 250 mm. At least one doorway will have a step that is no higher than 200 mm above street level.

Doors
At least one door will have a free width of no less than 750 mm, so that a passenger in a wheelchair can be conveyed into the bus.

Handles, railings and supports
To facilitate boarding and debarking, all door openings will be provided with contrast-marked handles and railings on both sides of the step. There will be a handle and a support for leaning a cane against where the fare is paid. Contrast-marked handles or supports will be provided to help the passenger move about inside the bus. There will be support belts at all places designated for passengers in wheelchairs.

Taking wheelchairs on board
At wheelchair entrances, the floor height will be no more than 230 mm. Otherwise, the bus can be fitted with, or prepared to receive, solidly fitted hoisting devices for wheelchairs. (Not applicable to buses used only in city traffic.)

Floor material
Material with little risk of slipperiness will be used.

Seats
There will be at least two front-facing seats especially designated for disabled passengers. There will be contrast-marked support handles at a distance of 230-300 mm in front of the front edge of the seat, and at a height of 750-1100 mm above floor level.

Space for wheelchairs
The bus will be provided with space for wheelchairs; the space will have a flat floor surface of 800 x 1300 mm.

Interior fittings
The material used will, to the extent possible, not cause allergic reactions. Surfaces with which passengers cannot avoid contact will not have an outer layer of chromium or other nickle alloy.

Ventilation
The ventilation will be capable of 12 changes of air per hour in buses with more than 19 passengers, and at least 8 in other buses. Passengers with allergy problems will be referred to a suitable location, and passengers with fur coats to a different location.

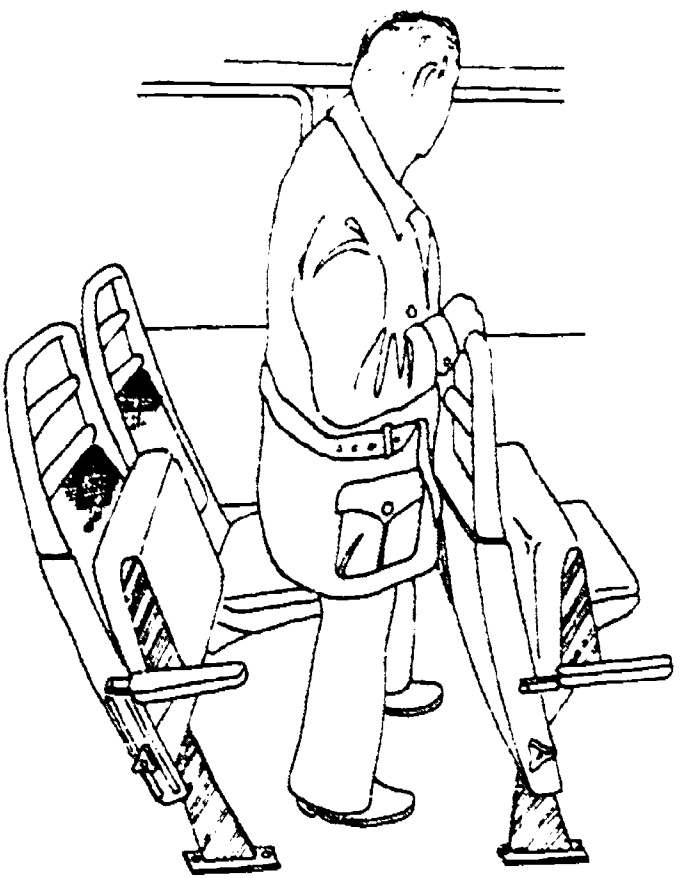
Lighting
The lighting will not dazzle. It will have at least 100 lux in stairs, at the fare box and on reading level at seats. The intensity of

general lighting will not exceed that of reading lighting by more than 50 lux.

Practical modifications are often difficult

In many situations, the regulations give a detailed description of design and execution. There are great difficulties, nevertheless, in finding solutions that function practically. Research and experiments have sometimes indicated solutions not governed in detail by the regulations. One example is handles and railings at the exit door; another is the location of seating for the disabled.

Many buses have handles and railings at the exit doors. In order for the railings to really be helpful during debarkation, they must provide support a little way beyond the side of the bus. (TFB Stencil #22)



Fold-up seats increase the space between rows and significantly facilitate getting up.

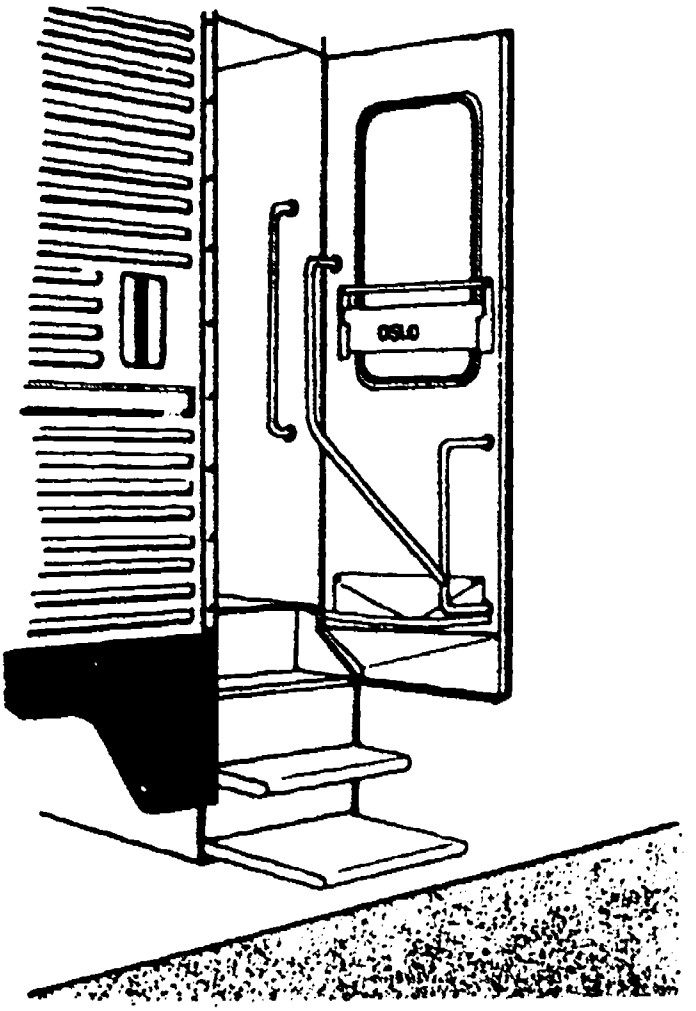
The measurement for disabled seating is based on a suitable location for handles and the minimum distance between seats to enable getting up. If there is a straight wall in front of disabled seating, the specified measurement may provide too little footroom.

Wheelchair hoists in buses

It is difficult to provide a good hoist for wheelchairs in an ordinary bus without extensive conversion. However, new constructions that can do the job have appeared during the past few years. Feasibility tests of a new wheelchair hoist concluded that its technical function was good, and that it provided good safety for the wheelchair passenger and his/her helper. The tests also showed that the stop time at a bus stop where a wheelchair passenger got on or off varied between 2 and 4 minutes. (TFB Memorandum # 18)

Train

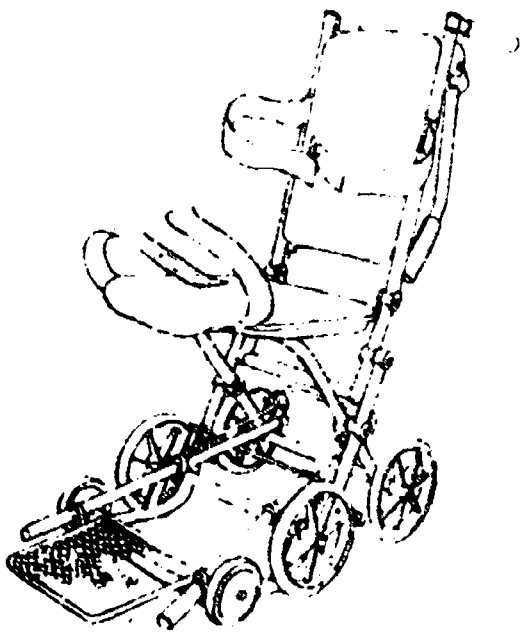
The regulations for adapting train, trolley and subway cars for the disabled generally conform to those for buses. Handles, supports, designated seats, etc., are treated similarly. The entrance step varies according to the various prerequisites of different vehicles. One of the greatest problems for train passengers is precisely the height of the entrance step. It necessitates high platforms as well as many steep steps into the car. Consequently, new step construction has been illustrated in the investigations.



Pneumatically projectable steps make entering and leaving railway cars easier and safer.

To facilitate matters, the Swedish Railway has a supply of special conveyance chairs that can be ordered when the ticket is booked. A new type of car includes door and corridor widths that accommodate wheelchairs.

With regard to new railcars, the regulations place extensive demands on adaptation for the disabled and entrance doors with hoist devices. Railcar Type X2, for example, which the Swedish Railway will introduce on the Stockholm-Gothenburg line, will be equipped with two hoist devices and a special compartment adapted for disabled passengers.



The conveyance chair is often necessary for moving disabled people on and off narrow vehicles. The Brio Travemünde chair has performed best in tests in narrow passageways.

Plane

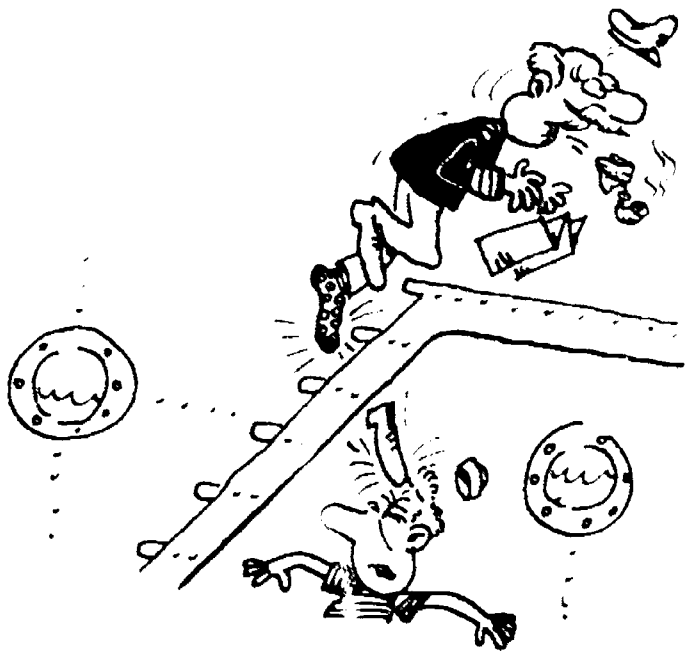
The regulations for passenger planes apply to deliveries after 1986, and differentiate among different sizes of aircraft. Toilets are not required on smaller planes (25-49 passengers). General regulations applying to all planes require that at least 2 seats be designated for disabled passengers. Such seating places will provide adequate room for sitting down, being seated comfortably, and getting up. The backrests will be reclinable, and there will be fold-up armrests. In addition, there will be a conveyance chair on board if the passenger has requested one when making the reservation.

Airplanes are often characterized by very restricted dimensions for entrances, passageways, toilets and seats. Ordinary wheelchairs do not normally have carrying handles, and they are too wide for the passageways. Passengers confined to wheelchairs should therefore be transferred into narrower conveyance chairs designed to be carried up and down stairs. The specifications for conveyance chairs vary,

depending on whether they are to be used inside the terminal or inside the aircraft. The design of the handles for chairs to be used for boarding and debarking is important. There is careful documentation of the measurement and function specifications for conveyance chairs.

Boat

Boat traffic accounts for a small portion of Sweden's public transport. In the archipelagos, however, it can often be difficult to find alternative means. That underscores the demand that passenger ships be designed in anticipation of their passengers' varying degrees of functional ability. The regulations apply to ships in Swedish coastal traffic, and are designed for 100 passengers or more.



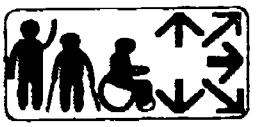
Measures that mean improvements for all passengers are recommended in "Handikappanpassing av skärgårdsbåtar, En handbook" [Adapting archipelago ferries for the disabled: a handbook]. Open staircases should be avoided.

"Adapting archipelago ferries for the disabled: a handbook" points out that many of the measures recommended

for providing better accessibility for disabled people also benefit others. Vessels will be better, in terms of both seaworthiness and working conditions. At the same time, there will be enhanced comfort and accessibility for all passengers on board.

Taxi

The regulations deal only with adaptations to vehicles used to transport passengers sitting in their own wheelchairs. The rules cover locking devices for wheelchairs and belts for wheelchair seating. Although taxis are the commonest means of transport for the disabled, there are no specified measurements or other regulations stating that taxis must be adapted for the disabled.



Adaptation for the disabled: Little effect thus far

The so-far gradual adaptation of mainly local and regional public transport for the disabled has not produced results. Nothing indicates that more disabled and/or elderly people prefer buses or trains to other modes of travel, despite the adaptation measures that have been introduced. In one study, at least 30% of elderly people entitled to Special Transportation Service have said that they thought they were able to use public transport. Medical examinations in connection with the same study indicated that 25% of those entitled to STS should be able to use public transport. One of the reasons why adaptation for the disabled has not led to their greater use of public transport may be that STS has been developed so well and functions so well. (TFB Stencil #22)

A number of studies, on the other hand, indicate that passengers find it more pleasant, in some sense, to take the bus after adaptation measures have been introduced. So-called "kneeling buses" have been studied in Gävle. The bus can be lowered at the front door and thus facilitate entry. The results suggest that everyone can get on board faster, and that boarding is made easier for people with locomotion problems.

Generally, however, the results suggest that kneeling has little significance. For people with impaired locomotion, getting off the bus is more difficult than boarding it. Debarkation is normally via the back door, which usually has a higher step than that at the front door, and inferior railings. The kneeling at the front is intrinsically good, but inadequate. (TFB Stencil # 22) The Gävle experiment also indicates that the front door is not very often used for debarking.

Debarking is a greater problem than boarding. Handrails are of decisive importance for disabled people's being able to leave the bus.

In order to find a practical solution, the Transport Research Board (TFB) and the Malmö Municipal Transit Authority equipped a demonstration bus with a special fold-out

step at the exit door. It compensates for the difference in levels between the bus and the sidewalk, and makes it easier to debark. In addition, these doors have extra railings that are easier to hold onto when getting off. (TFB Stencil #49)

11. Terminals, Stations and Bus Stops Prevent Much Travel

The solutions for the travel problems faced by disabled people are not only to be found in the design of vehicles. That is only one link in the whole chain of difficulties. The examples of problems confronting the elderly and disabled in Chapter 9 indicate clearly that the bus stop, and the way to and from it, are even greater obstacles for disabled people who want to use public transport. Studies in Skellefteå and Malmö revealed that 40% of the elderly said that they had problems finding a place to sit down, as well as protection from the weather, at bus stops. (Ståhl 1986, Elderly People and Traffic)

The government has directed the Housing Department (formerly the Planning Department) to introduce regulations for the adaptation of terminals to the requirements of disabled people. While this assignment is not yet finished, it has produced an almost complete survey of the numbers, and the shortcomings, of different types of terminals. This inventory includes subway stations, train stations, airports, harbors, bus terminals and bus stops in several cities and counties. The undertaking has been directed on a consultation basis by architect Gunnar Holm.

TYPE	NUMBER
Bus stops for regional bus service	96,000
Bus stops for municipal bus service	21,000
Large bus terminals	57
Subway stations	97
Municipal railway stations	155
Other railway stations	384
Airports	40
Harbors	33

Numbers of bus stops, stations and terminals in Sweden.

The content and extent of adaptation

When it comes to specifying what measures should be taken, the Housing Department's inquiry has drawn up a list based on the guidelines produced by the HAKO Commission. Using these guidelines, a checklist has been constructed for evaluating the deficiencies of terminals. Several of the measures may be seen as fulfilling the basic requirements that might be introduced at terminals and bus stops regardless of size, while others are feasible only at larger terminals. Thus,

bus stops and terminals have been grouped according to traffic density. Discussions with organizations of disabled people, municipal governments, transit companies, researchers, etc., have resulted in a proposal for priorities, from 1 (highest) through 3 (lowest). Examples from the working papers have been adduced to illustrate how the results may fall out. The accounting of airport deficiencies illustrates how the work is organized and what different kinds of measures are needed.

Classification and Deficiency Analysis of Adaptation Measures for the Disabled at 40 Airports. (Working Paper)

	Large		Medium		Small	
	Nr	Priority	Nr	Priority	Nr	Priority
Information						
Telephone information	0	1	0	1	0	1
TV information	0	1	2	2	13	-
Loudspeaker information	0	1	1	1	2	1
Legible timetables	4	1	18	1	12	1
Convenience						
Parking within 25 m of the entrance	0	1	2	2	8	3
Alarm system in the parking lot	3	1	18	2	18	3
Debarkation at the entrance	0	1	0	1	5	1
Advance ticket reservation	0	1	0	1	0	1
Reservation of conveyance chair	0	1	0	1	3	1
Reservation of an attendant	0	1	0	1	0	1
Inclined walkways	2	1	0	1	3	3
Contrast painting and touch marking	4	2	18	3	18	3
Automatic door opening	0	1	4	2	11	3
Elevator to upper levels	0	1	0	1	0	2
Hearing loops or the equivalent	4	2	18	3	18	-
Railings where they are needed	4	1	18	2	18	3
Supports by the ticket window	1	1	9	2	12	2
No-smoking waiting spaces	2	1	15	2	11	2
Lavatory for the disabled	0	1	0	1	4	2
Seating accessible to the disabled	4	1	18	1	18	2
Telephone for the disabled	0	1	7	1	7	1
Augmented lighting	4	2	18	3	18	3
Climatic control	1	1	18	3	18	-
Lifting platform, hoist or elevator	0	1	8	1	3	1
Traffic Safety						
Short, straight walkways	2	1	0	1	1	2
No steps, staircases, etc.	2	1	0	1	2	2
No other obstacles	2	1	0	1	0	2
Separate walkways	1	1	7	2	12	3
Easily-oriented, uncluttered spaces	0	1	3	1	3	1
Total number of airports	4		18		18	

Number of airports with deficiencies in adaptation for the disabled and priorities for improvements. (Working Paper, Housing Department)

Classification and Deficiency Analysis of Adaptation Measures for the Disabled at 396 Bus Stops in Norrköping. (Working Paper)

	Large		Medium		Small		Mini	
	Nr	Priority	Nr	Priority	Nr	Priority	Nr	Priority
Information								
Bus stop post	11	1	1	1	3	1	4	1
Stop name	11	1	26	1	7	1	4	1
Route number	17	1	1	1	3	1	5	1
Timetable	21	1	2	1	19	1	7	1
Route map	217	2	115	2	53	3	11	-
Convenience								
Bench	162	1	96	1	34	3	11	-
Elevated waiting area	35	1	11	2	13	2	11	3
Shelter, 1 or 2 walls			114	1	53	-	11	-
Shelter, 3 walls	163	1	89	2	38	3	11	-
Waiting shed	216	2	115	2	53	-	11	-
Waiting room	217	3	115	-	-	-	-	-
Traffic safety								
Special lighting	217	1	115	2	53	3	11	-
Pull-in bus stop	118	1	24	1	12	2	10	3
Total number of bus stops	217		115		53		11	

Total number of bus stops in Norrköping with deficiencies in adaptation for the disabled and priorities for improvements. (Working paper, Housing Department)

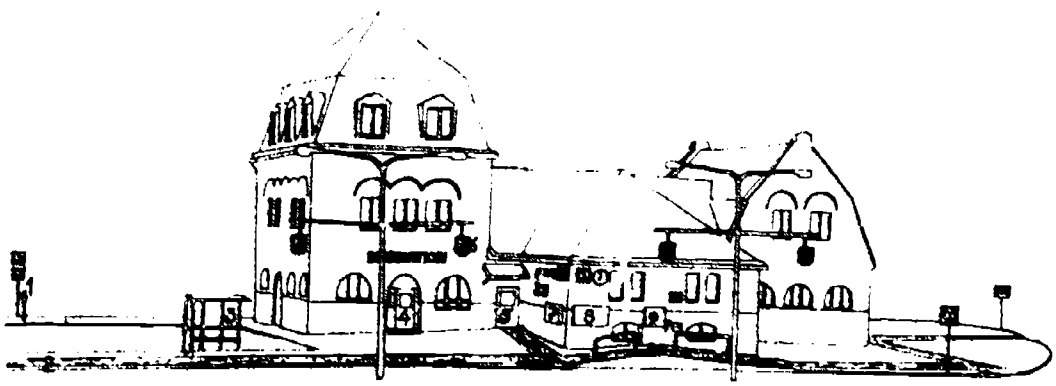
The terminal adaptation experiment in Hudiksvall

A full-scale attempt to test all of these adaptation measures has been carried out in Hudiksvall, in connection with the reconstruction of terminals for public transport. (TFB Stencil #2)

To facilitate boarding, one stop connected to the waiting room has been provided with a raised boarding ramp. From this stop, the passenger can send for the desired bus.

The bus drives up to the boarding ramp, and the passenger can more easily step inside. A raised debarkation

stop was built at the approach to the terminal area, providing shelter as one walks into the waiting room. Parking for the disabled was laid out in direct connection with the terminal, and provided with facilities for contacting traffic personnel. Walkways within the terminal area and in connection with pedestrian crossings were provided with roughened concrete paving tiles that make it easier for people with poor eyesight to find their way to the terminal. Information and service were also improved as part of the experiment. An evaluation revealed that the passengers were favorably disposed to the improvements, but that very few took advantage of them.



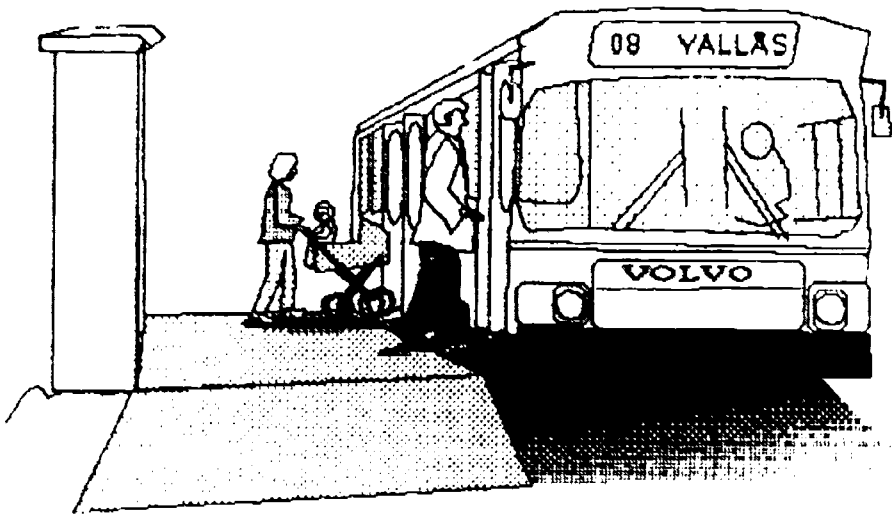
The Hudiksvall bus terminal has these features to accommodate the special requirements of the disabled. (1) special parking spaces (2) walkway for the vision-impaired (3) weather shelter (4) entrance to the freight department (5) entrance to the waiting room (6) bus stop sign (7) general information (8) central information board (9) route map (10) elevated bus stop

The process of modifying the terminal in Hudiksvall also produced a checklist of points to remember when building terminals. The checklist coincides for the most part with the Housing Department's list of adaptation measures. The Department's list contains some points regarding traffic safety that are missing from the checklist. On the other hand, the checklist has more examples of solutions, and a division according to details that is lacking in the Department's list.

Convenient bus stops for everyone

One radical solution to providing good boarding and debarkation conditions is to be found in Halmstad. The bus stops have quite simply been raised to the level of the floors of the buses. The passengers can just walk into the bus without

encountering a single step. The buses have been equipped with platforms that project when a bus stops at one of these so-called elevated stops. The platforms bridge the space between the bus and the stop. At an ordinary stop, an extra step folds out of the bus to form a stairway up into the vehicle.



At elevated bus stops, platforms project from the bus doors, eliminating steps.

Two evaluations have been made of the system, which has been in operation since 1979 and gradually expanded since then. The first was made in 1982, and the second in 1985. On the second occasion, the passengers were consistently more favorable to the system than when the first interview was conducted. There are probably two explanations: the system had been improved technically, and the passengers had grown used to it. Also worth mentioning is driver reaction. In 1985, 45% of the drivers were positive and 32% neutral, whereas the figures in 1982 were 49% negative and 25% neutral.

Why not build elevated bus stops?

Although elevated bus stops have functioned well in Halmstad, they have not yet appeared in other places. This may be partly explained by the higher cost of building elevated

stops. On routes that have few stops, however, such as those servicing airports, there should be no great objection. Passengers using airport buses often have a lot of luggage, and an effort should be made to achieve the easiest possible boarding and debarkation.

12. There Are Many Ways to Solve the Travel Problems of the Disabled

Technology is not the only issue

The initial studies of adaptations for the disabled dealt mainly with technical modifications of vehicles, e.g. to make it easier for people with disabilities to board a bus. Later studies, however, have shown that social factors, security and service are equally involved in solving the travel problems of disabled people.

An experiment in Gävle was designed to study what effect increased service from bus drivers (among others) would have on the possibilities for older people to take the bus (KTB Report 1984:29). This eliminated many difficulties, and about half the people interviewed thought that an improvement had been made. It is possible to appreciably improve the opportunities for older people to take the bus by modifying driver behavior and increasing service. The following measures are particularly important:

- better snow removal between domicile and bus stop, and at bus stops
- benches at bus stops
- the possibility for older passengers to be seated when the bus is in motion
- manual opening of doors
- stop announcements
- exiting via the front door.

There are also investigations suggesting that the difficulty of getting to and from the bus stop is experienced as just as great as the difficulty of getting on and off the bus. (KTB Report 1984:29)

Approximately 25% of all people entitled to Special Transportation Service would be able to take the bus if the trip gave the feeling of being safe and secure, if the driving were smooth rather than jerky, and if there were no risk of doors that slam shut again before one can get off the bus. Similar results were derived from an experiment with Service Routes in Borås. There, people entitled to STS say they do not need to use STS as often since a Service Route was located in their area. (TFB Stencil #22, TFB Memorandum #42)

An analysis of older people in Gothenburg showed that many of them have STS even though it cannot be justified objectively. The study suggests that if public transport is made more accessible, more people can use it. (TFB Memorandum #38)

Level passageways are important, because even small irregularities can cause big problems.

A study of long-distance travel showed that ca one-fifth of the passengers using planes, taxis or special-purpose vehicles under national STS entitlement would have been able to take the train instead if they had been accompanied by an attendant. Other investigations also indicate that travelling can be facilitated for disabled people by means other than vehicle modification.

More imagination is required to find solutions for sparsely-populated areas.

Many older people still live in depopulated areas. There, the problems and the costs of finding solutions for the elderly and disabled are greater. Experiments have revealed a number of solutions that can be used depending on local circumstances.

Supplementary transport shortens walking distances.

Supplementary transport basically runs on normal routes, but only when someone wants to travel. It is often managed by means of taxis, which pick people up at the door and drive them to a store or a bus connection. Supplementary traffic is available throughout Sweden. When it is introduced, it greatly reduces the walking distances associated with normal route service, but the trip frequency is usually worse.

Community buses can provide door-to-door service.

Community buses are driven on a volunteer basis by people who live in the community. The route is determined by the passenger, which permits adaptation to the travel needs of disabled people. This service works best in communities that have a strong organization that handles the responsibility. Community buses have as a rule come into existence for reasons other than accommodating the travel needs of the elderly and disabled.

Ride sharing in STS

When different systems have been tested for organizing ride sharing in STS, it has been difficult to prove that the coordination work involved pays off. Ride sharing on individual initiative has been tried in Piteå, with good results. There, people not entitled to STS are invited to ride on STS trips. When coordination was introduced, everyone who participated travelled cheaper than if they had travelled independently by STS and bus. As a result, people with STS got cheaper trips, and those without STS got more chances to travel. (TFP Memorandum #24)

Ride sharing in private cars

Several large attempts to organize ride sharing in private cars have yielded very poor results. The more some authority has been involved in administration and financing, the less effect the attempt has had. Voluntary ride sharing in private cars works better, and is significantly improved through tips about coordination and through help in locating people who want to share rides.

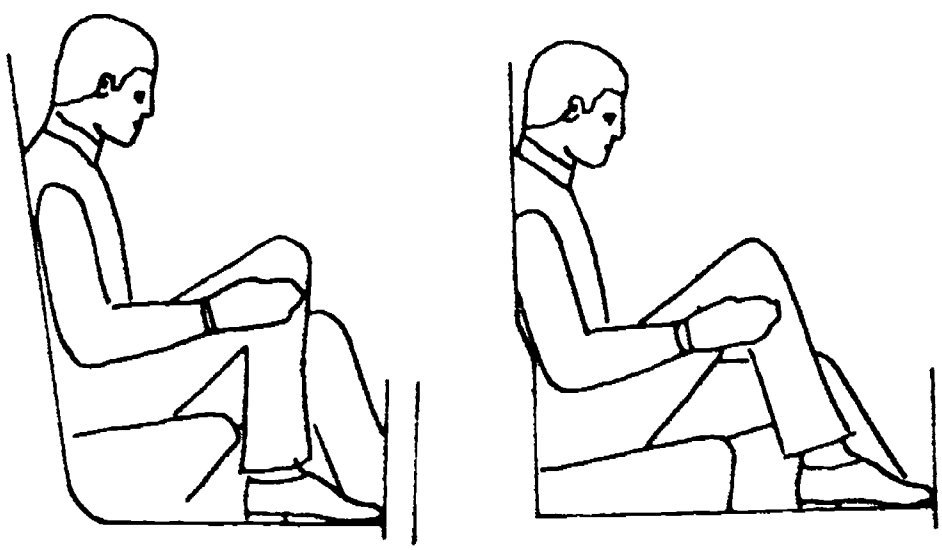
13. There Are No Taxicabs Suitable for Transporting the Disabled

A taxi's design should pay great attention to disabled people. However, the minimum measurements drawn up for vehicle inspection do not fulfill the requirements of disabled people. Their greatest difficulties are associated with getting in and out. Available studies deal partly with the dimension requirements for different movements while entering and leaving a vehicle, and partly with compiling different measurements that will let getting in and out function reasonably well.

Design requirements for a taxi

If one were to specify the requirements for a taxi from the point of view of making it possible for a disabled person to get in and out, the following items could be adduced.

1. The seat should be relatively firm all the way out to the edge. It should be upholstered, at least on the sides of the sitting surface, in material that does not offer too much friction when a person turns and moves on the seat. The height of the seat should be at least 50 cm above ground level. The angle of the back should not exceed 10 degrees. The seat should be easy to move back into its last position.

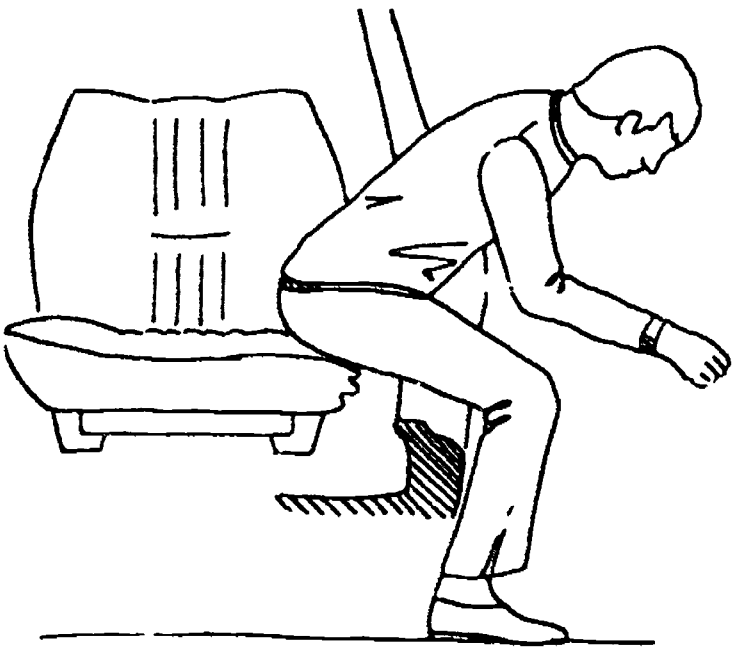


If the door opening is narrow, the leg has to be bent a lot when it is drawn into the car.

2. The sill should be as low as possible in relation to ground level, preferably under 35 cm. The sill should have a rounded edge so that it is easy to pull one's feet over it.

3. The door should be able to open at least 80 degrees, and it should not have a glove compartment.

4. Handles should be located on the dashboard, on the inside of the ceiling above the door, and on the inside of the door.

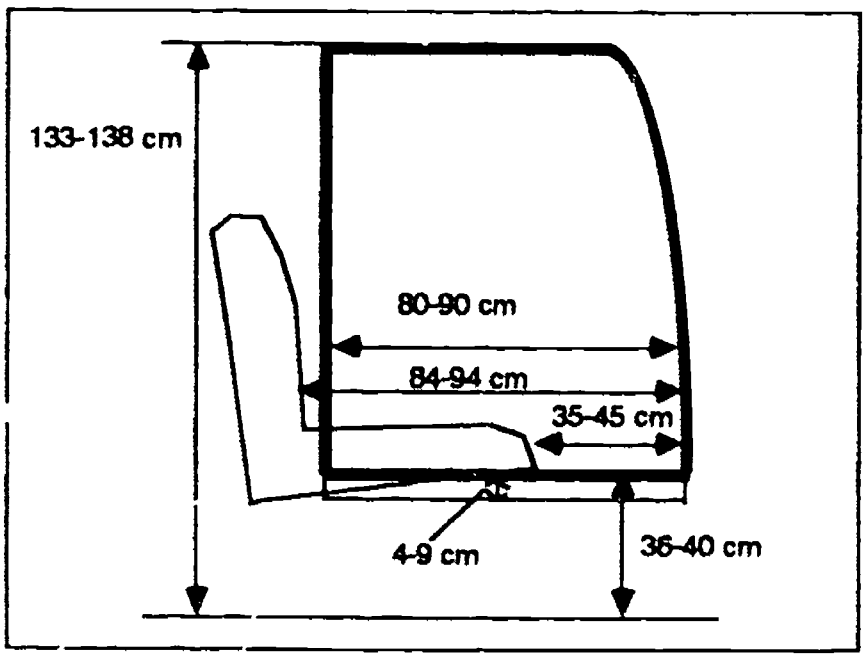


When rising from the seated to the standing position, the most important factors are the height of the seat above ground level, and suitably located handles.

5. Measures: The opening of the dorr should have the following minimum measurements:

	Door Width	Door Height	Distance Back-Bar	Entry step	Sill
Functional measurements	80-90	133-138	84-94	36-40	4-9

These specifications do not describe any ordinary passenger car used as a taxicab. The back doors do not even come close to meeting the needs of a disabled person. The measurements for front doors are reasonable, except for the height. Minibuses used as taxis have an adequate door height, but the entry step and floor are too high. This makes the seats so high that one cannot sit on them directly from ground level, without getting into the vehicle first. That in turn means that the ceiling is so low that one must bend over to step around. Lifting a person from a wheelchair into a minibus is nearly impossible. In order for a passenger to be able to sit in a wheelchair during a trip, the distance from floor to ceiling should be at least 145 cm.



Functional measurements for the front door of a taxi. The back doors of all ordinary automobiles are so narrow that they create obstacles for the elderly and disabled when they get in and out.

Customized taxi vehicles

Several attempts have been made to build taxis that can accomodate wheelchairs. Here and there in Sweden there are isolated examples of rebuilt passenger cars. Attempts have also been made in other parts of the world, but no one has found a solution that has met with general acceptance.

One example of an attempt to solve the problem was Volvo's experimental car for Special Transportation Service. It was a 1974 Volvo 145 that was stretched 700 mm and raised 540 mm. Trials showed favorable results. People confined to wheelchairs, and others with impaired l otion, were equally pleased. The front seat design p. superior to modifications made on earlier taxis. Th eased door breadth and height, the design of the seat, ano . bevelling of the sill were improvements that made i. significantly easier for disabled passengers to get in and out of the car. Nor did the personnel have any objections worth mentioning.

(Handicappforskningen [Disability Research] Stencil 48, TFB Memorandum #5)

Special-purpose vehicles are fitted and equipped for passengers confined to wheelchairs. The effort to hold down costs through ride sharing means that other disabled people may also be transported in such vehicles.

Special-purpose vehicles are modified minibuses, vans or passenger cars. The changes required are, above all, hoists or ramps for taking the wheelchair on board, and locking devices inside. On some vehicles, it is also necessary to raise the ceiling.

Rebuilt vans are commonest, which means that passengers experience the trip as uncomfortable and bumpy, since the suspension is designed for heavy loads. The windows are often so low that a person in a wheelchair has a hard time looking out.

Ramps

In order for a wheelchair passenger to board and debark without assistance, the incline should not be greater than 1:12. This is usually impossible in a vehicular context, because the ramp becomes too long and hard to handle.

Shorter ramps with a 1:3 incline can be used if assistance is available for the passenger confined to a wheelchair. Such a ramp facilitates boarding a vehicle with a floor height of up to 60 cm. The ramp should be at least 100 cm wide, or provide protection when exiting.

Some types of customized passenger cars have suspension systems that can be lowered, enabling a wheelchair to be rolled in from ground level.

Hoists

A hoist is usually mounted on the back of the vehicle. To handle a person in an electric wheelchair and an attendant, a hoist should have a lifting capacity of at least 400 kg. If one can roll straight into the vehicle from the hoist deck, it can measure 90x160 cm. If the chair must be able to turn on the hoist deck, it should measure 160x110 cm. A hoist deck intended for one person in a wheelchair can measure 70x120 cm; such a deck should provide protection when exiting.

Measurements

The width of the door should be at least 80 cm to permit rolling in a wheelchair safely and easily. The door height should be 180 cm so that an attendant doesn't bump his/her head. In order for a person confined to a wheelchair to sit in it

during the trip, there should be an interior floor-to-ceiling height of at least 145 cm. (Disability Research Stencil 32)

Most special-purpose vehicles are registered as taxis. The dominant minibus so registered is the Volkswagen. VW minibuses account for over 80% of such vehicles registered as taxis.

The floor height in the commonest minibuses is less than 60 cm, and loading can therefore be done using a ramp. They usually have an inadequate door height; taxi personnel learn to enter without hitting their heads, but the low door height can be a problem for people with impaired locomotion. Some special-purpose vehicles registered as taxis also have a ceiling that is too low to enable a passenger in a wheelchair to sit comfortably during the trip. (TFB Memorandum #63)

Automobile	Door Width	Door Height	Seat Height	Floor Height	Floor-to-Ceiling
Fiat Ducato	104	137	113	57	152
Ford Transit 120	103	125	101	53	133
Ford Transit 130	103	125	106	57	152
Mazda E2000	104	125		62	135
Mercedes 309	107	150		69	155
Peugeot J5	104	137	113	56	184
Renault Traffic 88		137	107	51	152
Toyota Hi-Ace	106	137	96	58	134
VW Caravelle	106	132	94	46	147
VW Transporter Raised	106	132	100	46	188
VW LT31 Raised	108	173	110	69	187

Measurements of ordinary special-purpose vehicles according to Bilfakta Transportbilar [Vehicle Information, Delivery Vehicles] 1988.

15. Small Buses Suitable for Service Routes

Several different small buses have been tested for Service Routes in Borås. The Borås Municipal Transit Company was first to introduce Service Routes, and has thus faced the greatest challenge to find suitable vehicles for them. The experience gained in Borås reveals that minibuses and other special-purpose vehicles often cannot stand up to the wear and tear of daily city traffic. Large vehicles built for such hard conditions, on the other hand, do not fit into route networks drawn close to domiciles and service institutions.

Several types of buses have been tested for use in Service Routes in the project "Small Buses for the New Swedish Traffic Conditions." During 1987 and 1988, the Neoplan N407 SK, Orion II Model 02-501 and Renault Master T35 were subjected to technical evaluation by the transport company and the bus drivers, and judged by the passengers. An earlier Neoplan model, N906T, met the demands for a Service Route bus, but had too little seating capacity for traffic in Borås. Trials with a larger bus, the Van Hool AU 138, demonstrated that the passengers' needs must be fulfilled in order for Service Route traffic to function. The tests showed clearly that the passengers preferred the Orion bus. It is large and roomy, has a level floor, has no steps inside, and is easy to enter and leave.

Orion

Positive	**Negative**
Easy to board & exit	Same-door boarding/exiting
Plenty of room	Narow space between some seats
Level floor	
No steps	
Plenty of stop buttons	

Neoplan

Positive	**Negative**
Easy to board & exit	Steps inside the bus
Comfortable to ride in	Seats facing backwards
Roomy	Lack of armrests
Wide center aisle	
Stop buttons at every seat	

Renault	
Positive	**Negative**
Easy to board & exit	Too small
Quiet operation	Too few seats
	Step inside bus
	Uncomfortable side seating

Passenger interviews show very clearly that it is not enough to offer a small bus with a good entrance. For a bus to be suitable for Service Route traffic, it must also have a comfortable, amenable interior. Steps on the inside, and side-facing seats, diminish the possibilities of using the bus by the group of passengers one is trying to serve.

The interviews have shown that there is one bus, the Orion II, that satisfies in principle all of of the demands placed on a vehicle by the passengers on Service Routes. (Ståhl et al 1987, Servicelinjebussar [Service Route Buses])

The response to the Orion bus was very favorable, not only because of the low entrance step but also because, inside the bus, there are no steps and no side seating.

16. Traffic Safety for the Elderly and Disabled

People in wheelchairs can be seated safely while travelling

Many disabled people have skeletal anomalies that can increase the risk of injury. Collision trials using the commonest wheelchairs, and different methods of securing the chair and passenger, revealed that locking down the wheelchair and providing a lap belt does not provide adequate protection. Even sudden braking can mean serious internal injuries from a lap belt. Greater safety is provided by a three-point belt affixed to the vehicle. Of course, the wheelchair must be separately anchored. Adequate protection can be achieved only if the wheelchair passenger is transported while facing backwards.

With regard to moving to and from the vehicle, the greatest hazards arise when the disabled person has to be carried up and down stairs. At the vehicle itself, moving the passenger in and out must sometimes be done in difficult working positions, but the greatest risks occur when the wheelchair is rolling on a ramp or hoist. (Disability Research Stencils 29 and 32)

Older people suffer more injuries in traffic than other travellers.

The elderly are more vulnerable in traffic, and injured more often. With regard to drivers killed or injured, the young and middle-aged dominate in terms of numbers. When the amount of travelling is factored in, another picture emerges. The number of killed and injured per million passenger kilometers is significantly higher for the elderly than for younger people. Yet it is not customary to take into account those accidents where pedestrians fall down. Single accidents account for 85% of all accidents for elderly pedestrians. Older pedestrians hurt themselves because of deficiencies in pavement maintenance. A study in Malmö shows that nearly 80% of accidents involving an older person being struck by a vehicle occur at intersections, and that 65% occur at pedestrian crossings. At intersections regulated by traffic lights, the anticipated walking speed is 1.2 m/second. The normal pace for retired people, however, is lower, 1.02 for men and 0.86 for women over 69. This means that older people must hurry in order to make it, and that in turn means diminished opportunity to register information about the traffic situation.

Another important factor to consider is that the probability that an older person will be killed or injured in an accident is greater because of the fragility that accompanies advancing age. The number of people killed in traffic accidents is consequently three to four times higher among the elderly as compared with people in younger age groups. The number injured in traffic accidents is twice as high for the elderly. (Ståhl 1987, Äldre trafikanter och trafiksäkerhet [Older People and Traffic Safety])

Older drivers

The fundamental cause of the problems of older people in traffic is not functional impairment per se, but the fact that today's traffic is complicated. The kinds of accidents in urban areas that increase in proportion to the age of the driver include accidents when making turns, stop and yield violations, driving through red lights in daytime, and pedestrian accidents. These situations are characterized by being very complex and placing great demands on the driver. In rural areas, the elderly produce higher numbers of accidents overall at intersections. Both on straightaways and at intersections, older drivers are involved in a higher proportion of accidents involving unprotected road users than younger drivers. When older people can make use of their experience and nothing unforeseen occurs, they are less likely to be involved in accidents.

The investigation that produced these findings examined two groups of people, those over 75 and those who were younger. It revealed that there were far more accidents for the older group at intersections. It can also be said generally that the proportion found responsible for causing the accident increased with advancing years.

Older drivers need more time to make a decision than the "ordinary" driver. It is therefore better for the older person if the environment is so structured that problems are more spread out over time, rather than demanding that much information be obtained, and many decisions made, simultaneously. (TFD Report 1979:8)

Drivers with disabilities

The composite picture resulting from a number of investigations reveals that drivers who have disabilities do not, as a group, have a higher accident frequency than others. In Sweden, between 1952-1961, a study of disabled and non-disabled drivers was conducted in the counties of Gothenburg, Bohuslän and Halland. The frequency of traffic accidents and major offences was on the same level for both groups.

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Public Transport for Everyone

During the past decade, the travel opportunities of disabled people have been considerably improved in Sweden. Special Transportation Service, the adaption of vehicles, Service Routes, etc. have made it easier for disabled people today to participate in social life. This has resulted from extensive research and development projects, among other things.

"Public Transport for Everyone" provides a compilation of some 50 such projects. Here you can gain an overview of what has been done, and of what remains to be done. "Public Transport for Everyone" is a perfect resumé for whoever wants a ready picture of the travel needs and opportunities of disabled people in Sweden.

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